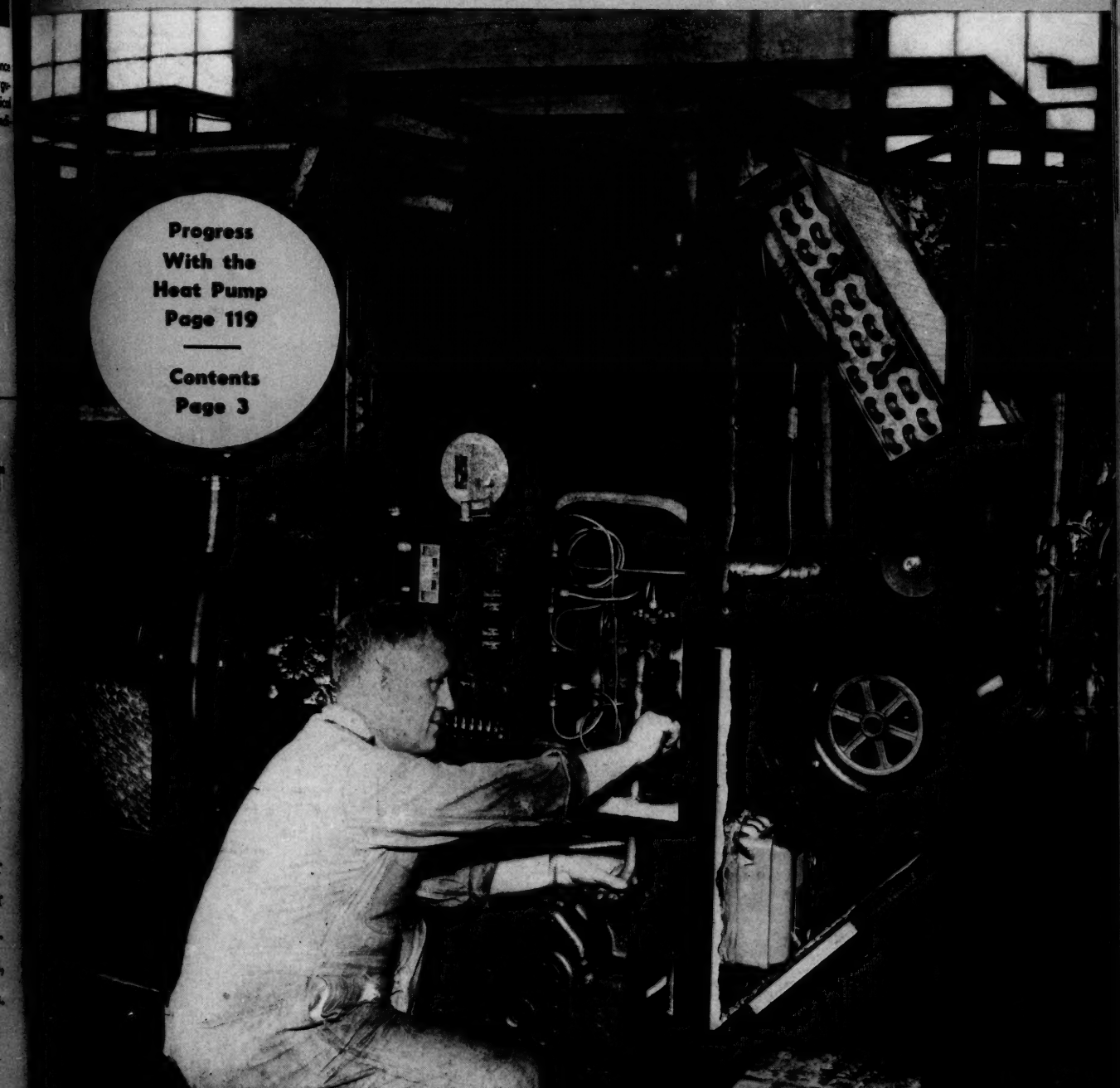
MARCH, 1954

HEATING AND VENTILATING

CLUDING AIR CONDITIONING – PIPING – REFRIGERATION – AIR SANITATION



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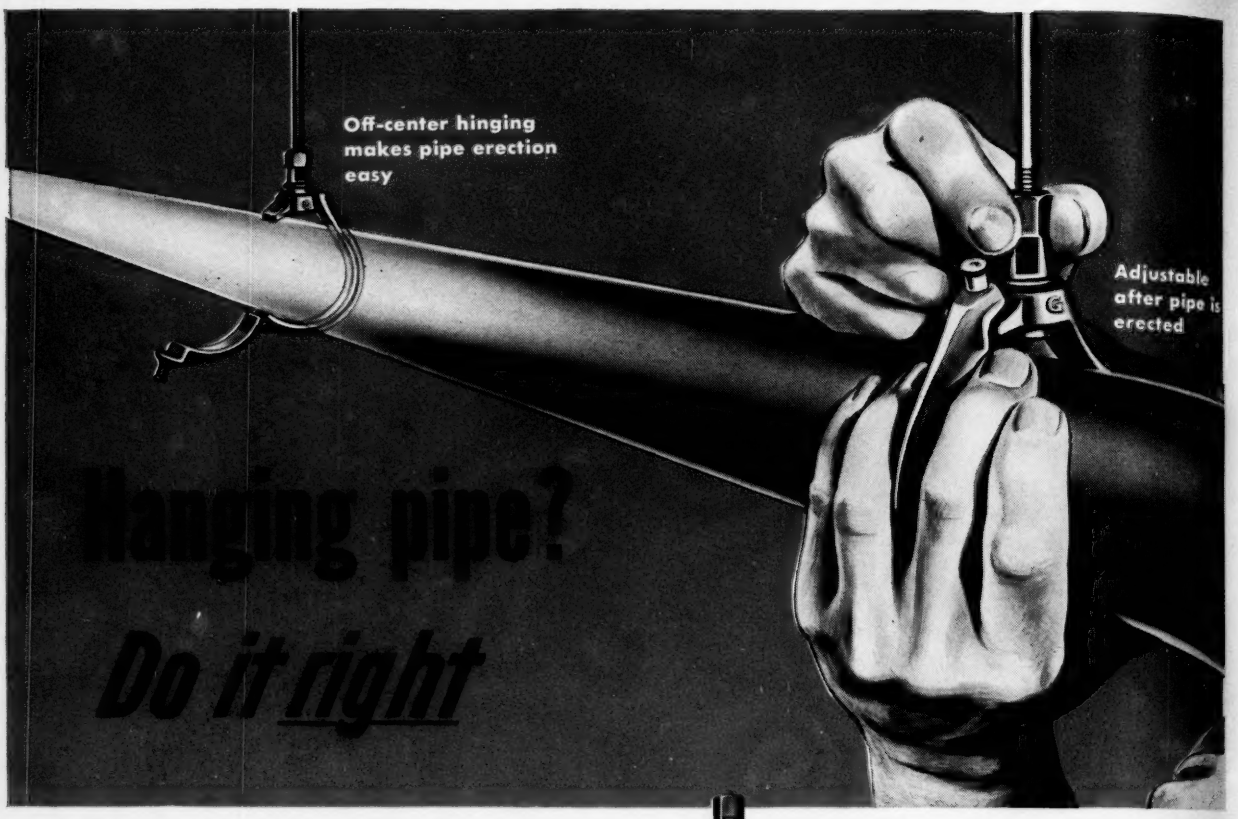


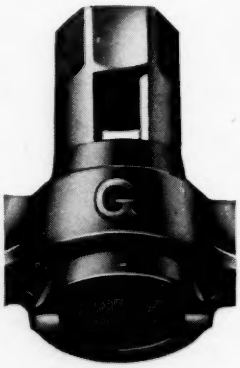
There's a stock Grinnell hanger for every piping requirement

SAVE MONEY ON ASSEMBLY. Cut installation time, get better, stronger installations, with Grinnell adjustable pipe hangers and supports.

NO SAG . . . NO WATER TRAP. Grinnell hangers permit adjustment after pipe is installed. This makes it possible to prevent sagging pipe and water traps, and assures positive drainage for the entire system.

FOR EVERY INSTALLATION. There is a stock Grinnell hanger for every need from simple water pipe to high pressure, high temperature steam line. Where necessary, there is a hanger to compensate for thermal movement.

PLAY SAFE. Don't waste time or take chances on inadequate pipe hangers and supports. All Grinnell hangers comply with rigid piping code requirements.



Enlarged section showing locking feature

GRINNELL ADJUSTABLE SWIVEL PIPE RING
(Split Ring Type)

- Hinging of ring is off-center. This provides sufficient seating to hold pipe before closing ring. Wedge-type pin is loosely but inseparably cast into the hinged section for fastening after pipe is in place.
- To obtain proper adjustment, swivel shank can be turned easily by hand when the weight of the pipe is temporarily taken off the ring.
- When weight is returned, patented swivel shank locks automatically, preventing change of adjustment due to vibration. Wire retaining ring keeps swivel shank and pipe ring or yoke from separating, makes assembly a single unit.
- 12 sizes have load range of 80 lbs. for ¾" size to 1510 lbs. for 8" size. May be used in connection with practically any building attachment.

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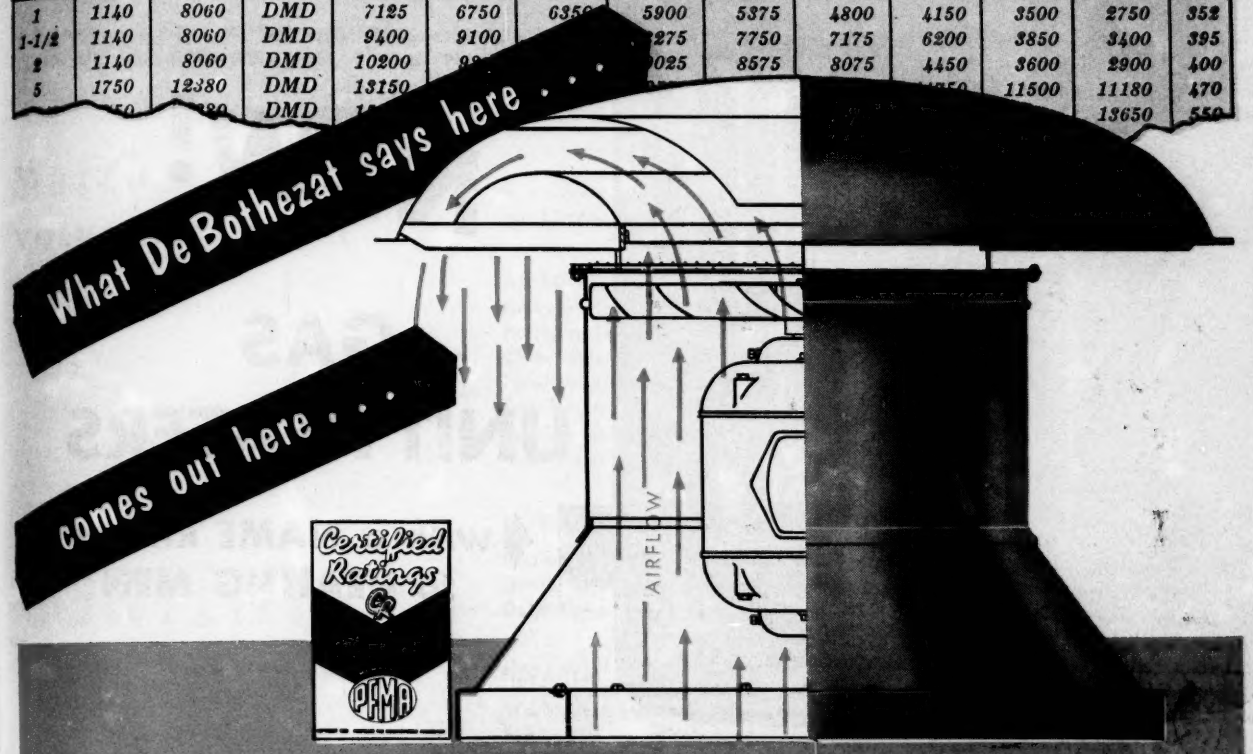
AMERICA'S #1 SUPPLIER OF PIPE HANGERS AND SUPPORTS

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

Manufacturer of: pipe fittings • welding fittings • forged steel flanges • steel nipples • engineered pipe hangers and supports Thermolier unit heaters • Grinnell-Saunders diaphragm valves • prefabricated piping • Grinnell automatic fire protection systems

TABLE OF CERTIFIED CAPACITY RATINGS

Motor HP	Fan RPM	Tip Speed	Drive	SP 0"	SP 1/8"	SP 1/4"	SP 3/8"	SP 1/2"	SP 5/8"	SP 3/4"	SP 7/8"	SP 1"	Net Wt.
1	1140	8060	DMD	7125	6750	6350	5900	5375	4800	4150	3500	2750	352
1-1/2	1140	8060	DMD	9400	9100		8275	7750	7175	6200	3850	3400	395
2	1140	8060	DMD	10200			9025	8575	8075	4450	3600	2900	400
5	1750	12380	DMD	13150							11500	11180	470
			DMD									13650	550



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Next time you buy or specify roof ventilators, consider their cost in terms of CFM. And for your own protection, ask the manufacturer how he arrives at ventilator capacity ratings.

DeBothezat capacity ratings are the output of the completely assembled roof ventilator, *including the head*. These ratings are obtained from wind tunnel tests conducted in accordance with NAFM Standard Test Code Bulletin number 110, Plate VIA. They conform with U. S. Dept. of Commerce Standard 178-51, which embodies the test codes of ASHVE, NAFM and PFMA.

WHY WAIT?

All members of the Power Fan Manufacturers Association have agreed to begin rating their roof ventilators this way within the next twelve months. You don't have to wait, though. DeBothezat Power-Flow Roof Ventilators are already so rated, and have been for years. Specify DeBothezat NOW and get all the air you pay for.

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DeBothezat Fans

Division of American Machine and Metals, Inc.
EAST MOLINE, ILLINOIS

DeBOTHEZAT FANS DIVISION
American Machine and Metals, Inc.
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The name back of this new line of Webster Gas Unit Heaters has meant good design, rugged construction and competent service to more than three generations of architects, engineers, heating contractors and building owners.

Webster Gas Unit Heaters are made in seven sizes, ranging from 25,000 to 200,000 Btu heat input . . . provide fully automatic, direct-fired heating for large or small areas. Burn natural, manufactured, mixed or LP gas. Approved by the American Gas Association and the Underwriters' Laboratories.

Webster Gas Unit Heaters are sold and serviced by long established and trained Webster sales engineers in 65 cities across the nation. Ask the nearest Webster Representative about Webster Gas Unit Heaters, or write us for Bulletin B-1710A.

The Webster Gas Unit Heater is the newest addition to the Webster Line. Webster Tru-Perimeter Heating with Webster Walvector for non-residential use or Webster Baseboard Heating for homes is an important recent development. Other Webster Heating Equipment includes Webster System Radiation, Webster Convectors, Webster Moderator Controls for steam heating, Continuous Flow Hot Water Heating Control, radiator valves, traps and other steam heating specialties, and Webster-Nesbitt Unit Heaters for steam or hot water.

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HEATING AND VENTILATING

A MONTHLY MAGAZINE FOR ENGINEERS AND CONTRACTORS CONCERNED WITH THE DESIGN AND APPLICATION OF AIR CONDITIONING, REFRIGERATION, PIPING, PLUMBING, AIR SANITATION, HEATING AND VENTILATION IN BUILDINGS

March, 1954
VOLUME 51—NO. 3

The Cover: Packaged type heat pumps being completed at plant of Worthington Electric Corp. Component units of assembly are illustrated.

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Editorial Staff

Editor
CLIFFORD STROCK

Associate Editors
NATHAN N. WOLPERT
WILLIAM B. FOXHALL

Publisher

THE INDUSTRIAL PRESS
Editorial and Executive offices at
148 Lafayette St.,
New York 13, N. Y.

President
ROBERT B. LUCHARS

Vice-President and Treasurer
EDGAR A. BECKER

Secretary and Publishing Manager
HAROLD L. GRAY

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Representatives

CHICAGO 1
George G. Turner
228 North La Salle Street.

NEW YORK 13
Harry J. Twine, Thomas A. Earing
148 Lafayette Street.

CLEVELAND 12
Edward B. McEntee
17115 Hillsboro Road.

LOS ANGELES 5
Robert H. Deibler
2506 W. 8th Street.

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Washington News

LORING F. OVERMAN

IN Washington during February, even some of the most enthusiastic Republicans began conceding that the dictionary might possible contain such a word as recession. Heretofore, only Democratic members of Congress dared to bring the ugly word out in polite company. Even then, such a suggestion was officialy pooh-poohed as scare talk.

By mid-February it became apparent that the Administration was going to have to concede that the public's pocket nerve has become increasingly touchy. It was equally obvious that the Administration might have to temper somewhat its approach to the whole problem of government and business; government and personal incomes.

Pocket Nerve Twinges

The previous Administration learned long ago that a single touchy pocket nerve can raise more fuss that than can be offset by any number of counter proposals "for the good of the greatest number." It is in this position that the present Administration now finds itself. Although its top brass is still firmly convinced that good health nationally demands a sound business community, such a policy causes all kinds of criticism from the individual who has neither the resources nor the confidence to hang on "for the better days ahead." Mr. Individual is more concerned, and understandably, with how he is going to solve his own personal and family problems today and tomorrow.

Tax Relief Picture Changing

To date, the Administration approach to the tax relief question has been on the basis, principally, of favoring aids to business, thereby stimulating increased business activity and boosting individual incomes indirectly. Democrats, on the other hand, insist that the way to stay in the saddle politically is to give tax relief to individuals.

Present indications are that the Administration—conceding that a politician out of office is no help to himself or the cause—will come up with tax legislation something like the following:

There may be another 5% cut in individual income taxes, in addition to the 10% which became effective January 1. There might be some cuts in excises.

Instead of receiving a cut in its 52% corporate income tax rate, business might be asked to continue with that rate until next year. The 52% rate is scheduled to be reduced on March 31, but political pressure may require that the reduction be passed along to individuals instead. Business may, however, expect some relief through revision of bothersome sections of the revenue code.

Construction Holds Up

Despite certain declines in employment and income, despite slowing down of auto buying and steel distribution, one of the odd things about the present situation is that private building continues at a record clip.

New construction placed in January was valued at $2.4 billion. Best January ever—up 3% from last January.

Non-residential was in the lead, with commercial and office building activity up 52%; with public utilities up 12% from January of last year.

Weakness showed in industrial building, off 10%; farm construction, down 10%; military and naval construction, down 20%, and remodelling and repairs, down 16%.

Possible explanation for the continued strength in the construction field is the fact that population is increasing at the rate of 250,000 a month—the equivalent of a St. Louis every 30 days. Population growth of that kind calls for a lot of new homes, stores, theaters, churches, schools and other facilities.

Reflecting this optimism in the building field, the producers of home air-conditioners are making extremely rosy predictions. At a Washington meeting of radio and television association people, a Philco Corp. spokesman forecast a 1954 market for 1.5 million air-conditioners as compared with 800,000 in 1953.

Another spokesman for the industry, the American Institute of Management, anticipates that the entire industry—home and commercial—will reach the $5 billion mark in sales in 1954.

Even if these estimates prove over-optimistic, it seems that the air-conditioning industries have much to look forward to.

Sea-Going Installations

For heating, ventilating and air-conditioning people who regard the shipyards as outlets, there may be more good news before too long. A Senate Sub-committee studying the government's maritime subsidy program has, in a preliminary study, come to the conclusion that quick action is needed to boost this segment of the national economy.

A preliminary report indicates that both in transport ships and in the facilities to build them, we are far below the preparedness level of pre-World War II days. The committee finds that, as potential military auxiliaries, there is an immediate deficiency of 214 merchant-type vessels. It finds that 80% of the active merchant marine will become obsolete between 1962 and 1965, and that much of it is already in that class. It also finds that the ship-building industry had no orders for ocean-going commercial vessels of more than 1,000 tons in 1953, and none in prospect for 1954.

The committee is working on a complete and constructive overhauling of policy and legislation in the ship-building field.

Refrigerated Warehouse Needs Cited

Another spot offering encouraging information to the refrigeration group is the list of expansion goals published in mid-February by the Office of Defense Mobilization. The list established five new production expansion goals, reopened 17 which had been suspended, and closed 29 classifications. One of the five "upped" includes refrigerated warehouse and storage facilities for defense requirements. ODM reports a need for 2 million additional cubic feet of refrigerated space in 1954 and

NEVER Ventilate a Ceiling or Wall Space to the Inside...

If you do, the better the insulation, the worse will be the condensation; for the colder the air in the space between insulation and roof, or walls, the less vapor can it support.

In new construction, moisture is evaporating from many tons of cement and plaster. Vapor flows from areas of greater density into this small, cold space, an area of less vapor density and small vapor capacity.

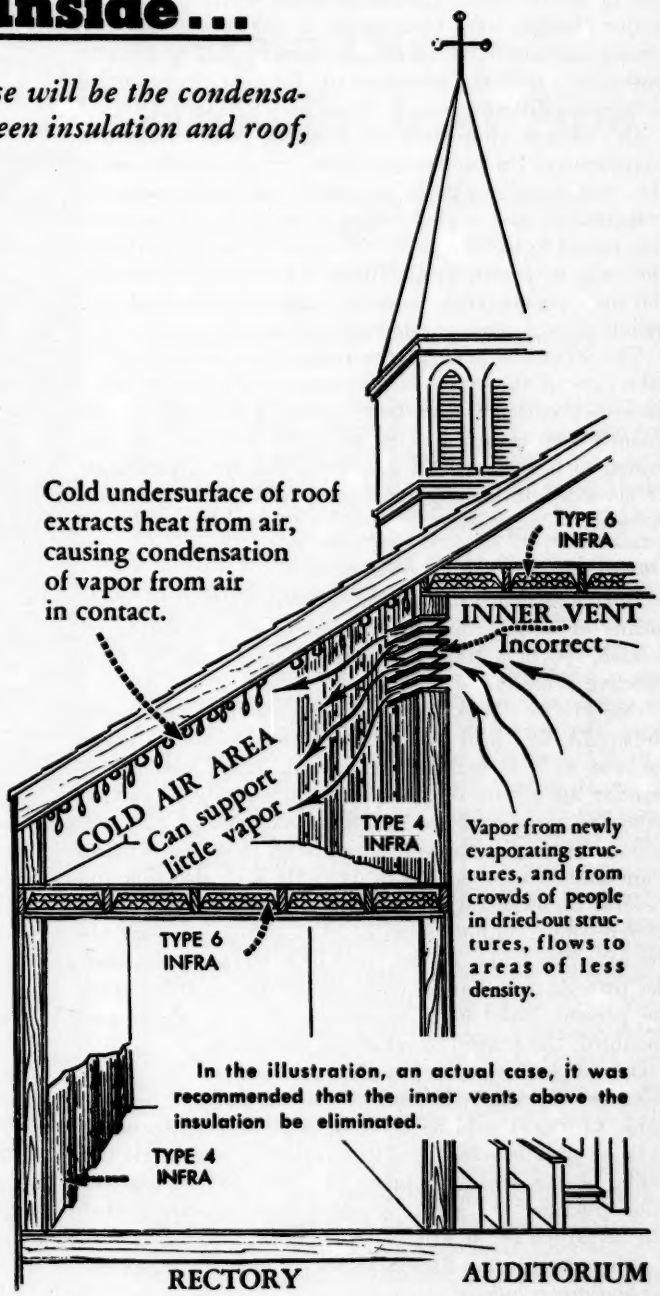
Where multiple accordion aluminum is used, fortuitous vapor and water (for instance rain) will gradually flow out, as vapor, through exterior walls and roofs as vapor pressure develops within. The vapor cannot back up through the continuous, impervious aluminum. It will flow out because walls and roofs have substantial permeability, by comparison far greater than the required 5:1 ratio. Infiltration under the flat stapled flanges of multiple accordion aluminum is slight.

Unusual amounts of vapor, as from crowds in theatres, churches, schools, stores, etc. must be adequately vented to the outside.

The new multiple accordion aluminum* Infra Types 6-S*i* and 4-S*i* forms a continuous blanket of uniform thickness between joists, giving the entire area maximum protection against heat loss and condensation formation. Write for samples.

The U.S. NATIONAL BUREAU OF STANDARDS has prepared a helpful and informative booklet, "Moisture Condensation in Building Walls" which discusses causes and cures. Use the coupon and we will send a free copy.

*Patent applied for


Cold undersurface of roof extracts heat from air, causing condensation of vapor from air in contact.
TYPE 6 INFRA
INNER VENT Incorrect
COLD AIR AREA Can support little vapor
TYPE 4 INFRA
Vapor from newly evaporating structures, and from crowds of people in dried-out structures, flows to areas of less density.
TYPE 6 INFRA
In the illustration, an actual case, it was recommended that the inner vents above the insulation be eliminated.
TYPE 4 INFRA
RECTORY
AUDITORIUM

COST OF INFRA INSULATION INSTALLED in new construction between wood joists, material with labor,

Type 6-S*i* under 9½¢ sq. ft.
Type 4-S*i* under 7½¢ sq. ft.

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1955. This would raise capacity from 10 million to 12 million cubic feet.

Necessity Certificates Procedures Changed

Industry members interested in expanding their facilities to accommodate defense business, will find that two major changes have been made in the regulations governing issuance of certificates of necessity. The certificates authorize rapid tax amortization for new or expanded defense facilities.

One change eliminated the so-called predetermination requirement. Under this provision, certain expansions in the past were ineligible for rapid tax amortization if construction had started before a certificate of necessity was issued to the tax payer. Purpose of the pre-certification was to assure proper usage of available materials during a period when acute shortage existed. That provision is no longer considered necessary.

The second change in the regulations is designed to take care of the taxpayer who expanded a facility after an expansion goal had been closed, but which subsequently was reopened. The tax payer will now be permitted to file with ODM an application for a certificate of necessity on the expanded plant within 30 days after the goal is reopened.

Pump-Priming Blueprint Urged

During a panel discussion in Washington to study means of anticipating projects to offset a possible recession, participating members disagreed as to most effective procedures.

One (New York City's Construction Coordinator Robert Moses) held that all blueprints should be ready for use at a moment's notice, with funds earmarked, standby agency on duty, and all states ready to participate. The speaker urged an immediate fund of $25 million, to be distributed to local agencies to screen existing plans and bring them up to date. He said also that the Federal highway-aid program should be bolstered by a Congressional authorization of $175 million per year for the next two years. In the event of a recession, he said, the formula for sharing costs should be modified from the present 50-50 basis to provide that the states pay one-third, the federal government two-thirds.

Opposing this view, another member of the panel (George W. Mitchell, vice president, Federal Reserve Bank, Chicago) said he believed public works spending to be an unsatisfactory tool to ward off recession. He felt public works spending takes too long to get started. "Construction," he said, "is not a type of activity that can be turned on at will."

Other steps in the Robert Moses formula for recession-prevention included:

(1) Elimination of the 10% limit on grant or loan funds for individual states under Title I of the Housing Act; and vesting of control of distribution of funds in the HHFA Administrator.

(2) Expansion of the recommended 35,000 units of public housing each year to 135,000 under the National Housing Act; provision for the President to disregard present limits in an emergency.

(3) Implementation of recommendations by the National Association of Home Builders for construction of 1.4 million homes per year for the next 10 years through FHA insurance. Authorize FHA to adopt a program of liberal interpretation in time of recession.

(4) An overall expansion of federal planning to include standby blueprinting of schools, hospitals, public buildings, water supply, recreation facilities, and multi-purpose civilian defense improvements.

All in all, the subject of what to do and how to do it, in the event of a further business slide which administration officials do not anticipate, is one of great interest and widely varying opinion in the Capitol city.

Applications Engineering Committees Named

Another step in the program directed toward ironing the "bugs" out of new military items before mass production orders are placed, instead of afterwards, has been completed. Frank D. Newbury, Assistant Defense Secretary for Applications Engineering (a post new to the Pentagon) has announced the appointment of six coordination and review committees to advise him regarding production engineering phases of projects emerging from the research stage. In the past, projects sometimes came out of the research laboratories and onto the production lines, only to find that major changes would have to be made before the new material could be used. It is anticipated that untold millions of dollars may be saved by eliminating bugs in advance of mass production.

Committees named by Mr. Newbury in his first formal action cover transportation equipment, exclusive of aircraft and ships; piloted aircraft; ordnance; marine craft and underwater ordnance; electronics, and guided missiles.

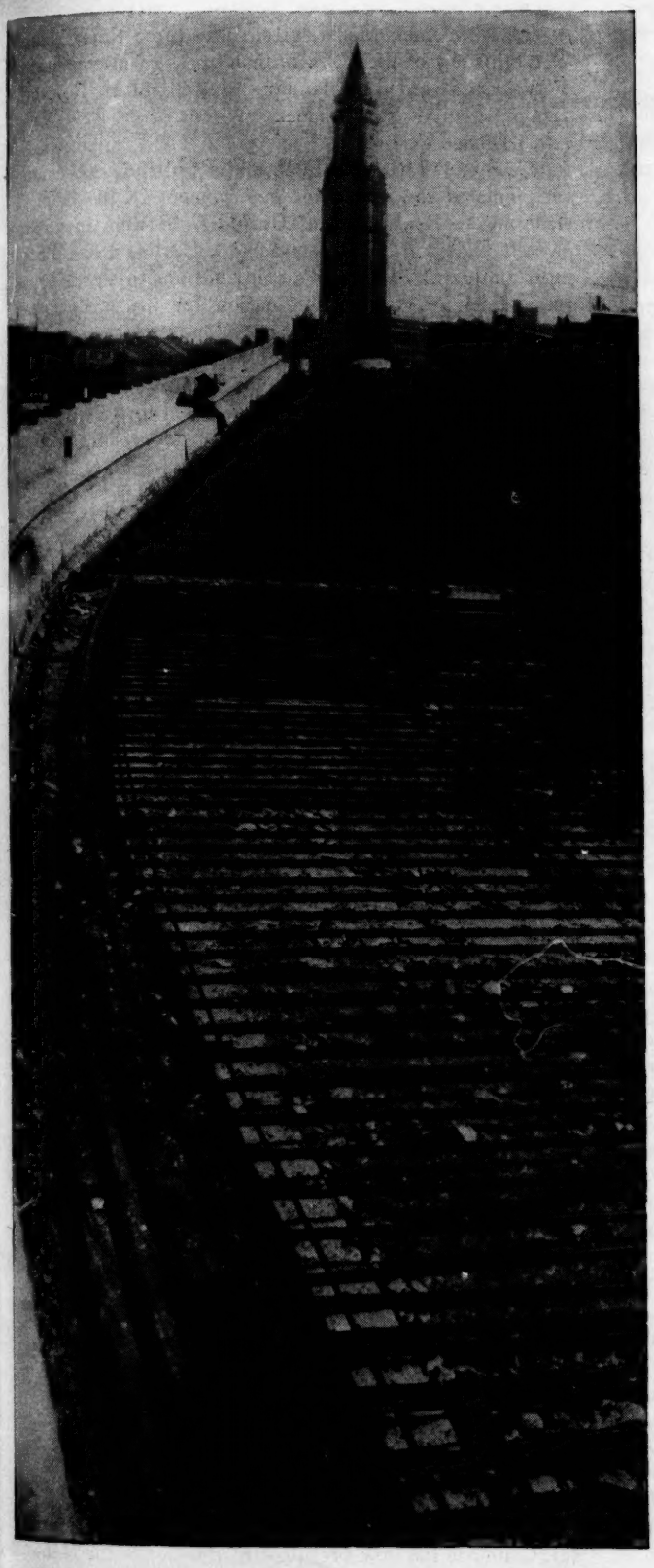
Washington Miscellany

Utilities Fuel Use Up. Use of coal, oil and natural gas by electric utilities companies during 1953 set new records, according to statistics of the Federal Power Commission. The figures are given in a year-end report, Consumption of Fuel for Production of Electric Energy, published by the FPC.

Coal consumption in 1953, says the report, totalled 115,893,587 tons, which was 8.2% above the 1952 usage of 107,071,241 tons. Electric utilities also burned 82,306,244 barrels of fuel oil during the year, for an increase of 22.4% over 1952 consumption of 67,218,426 barrels. Gas consumption in 1953 was 1,032,469,312,000 cubic feet, which was 13.4% above the previous record set in 1952.

The total amount of coal and estimated coal equivalent of other fuels used for utility generation was approximately 178,697,000 tons in 1953. The indicated 1953 coal rate, based on actual coal use and corresponding net generation by coal was 1.06 lb per kwh.

Government In Business. How far government has traveled down the road of competing with private business is documented in a new report, Government in Business, published by the House Committee on Government Operations. The report observes: It (government) operates over 100 business-type activities. It has stores inventories comparable to all private enterprises combined ($77.8 billion). It is the largest insurer, lender, tenant, holder of grazing land, owner of grain; warehouse operator, ship owner, truck fleet operator. A detailed listing of industrial activities of Federal agencies in six fields shows: manufacturing 55, services 27, transportation 10, maintenance and repair 7, construction 6, miscellaneous activities 9.



World's Largest Snow Melting System Uses Wrought Iron Pipe

More than 200 tons of corrosion-resistant wrought iron pipe forms snow melting grids on sixteen ramps serving Boston's 200-million dollar Aerial Highway

When completed, the access ramps leading tc Boston's Aerial Highway will be the modern answer to the winter motorists' dream.

Heated by coils of wrought iron pipe, these pavement ramps will provide a dry road surface in blustery cold weather months to protect the motorists from dangerous skidding hazards and the driving threat of winter traffic jams.

More than 200 tons of wrought iron pipe, selected because of its ability to resist corrosion and vibration, and its ease of installation, are arranged in series and buried in the concrete. To operate, steam supplied by Boston Edison Company, is fed to heat exchangers. Water mixed with Ethylene-Glycol anti-freeze, is circulated through the heat exchangers and wrought iron pipe network. The heated pavement melts snow as it falls, prevents ice from forming.

This modern expressway, designed by Architects-Engineers Fay, Spofford & Thorndike and the Commonwealth of Massachusetts Bridge Department, again reflects Boston's leadership in adapting snow melting systems to winter weather problems. The Merrill Company were Heating Contractors, and the V. Barletta Company were General Contractors. The Jarvis Engineering Company fabricated all pipe coils for the snow melting system.

Wrought iron pipe is establishing durability records in snow melting systems under sidewalks, store entrances, factory platforms, garages, hangers, and other surfaces where snow and ice create safety and production hazards. For complete details, write for our bulletin, WROUGHT IRON PIPE FOR SNOW MELTING SYSTEMS.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. Export Dept.: New York, N.Y.

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ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

BRIEFLY STATED

• Ruud Manufacturing Co. is planning to move its general offices from Pittsburgh to Kalamazoo, Mich, where it will occupy a new building to be available late in 1954 adjacent to its Kalamazoo manufacturing plant.

• J. Howard Smart, president of Tuttle & Bailey, Inc., New Britain, Conn., died January 2 after a year's illness. Mr. Smart joined the production department of the firm in 1923 and in 1926 entered the sales division. He was made assistant sales manager in 1930 and sales manager four years later. In 1941 he became a vice president of the company, and in 1951 was made executive vice president and secretary. In September 1952 he became president. Mr. Smart served as a director of Tuttle & Bailey, Inc., Tuttle & Bailey Pacific, Inc., Hart and Cooley, Inc., and Hart and Cooley Mfg. Co.

• Norman C. Curtin has been named to the staff of Public Relations Management Corp., as technical consultant to the newly created Anthracite Information Bureau.

For the past seven years supervisor of field representatives of the Anthracite Institute, in his new duties Mr. Curtin will serve as technical advisor in connection with motion picture productions and publications.

• The American Society of Refrigerating Engineers announces that on and after March 1, 1954 its headquarters office will be located at 234 Fifth Avenue, New York 1, N. Y.

• Maurice J. Wilson, sales engineer in the Atlanta district office of Carrier Corp., will join the Syracuse home office as a product specialist on Conduit Weathermaster systems. After winning degrees in mathematics from Drury College, Springfield, Missouri, and in electrical engineering from Georgia Institute of Technology, Atlanta, Mr. Wilson joined Carrier 23 years ago as a control engineer.

• Connor Engineering Corp. has entered into an agreement with Etablissements Tunzini, Paris, France, whereby the latter will manufacture all units of the Connor line of activated carbon air purification equipment for distribution in France, French North Africa, Belgium, The Netherlands, Luxembourg, Italy, Spain and Portugal.

• Worthington Corp. has announced the appointments of John E. Lancaster as chief engineer, Heavy Machinery Section, and Roland G. Ewer as consulting engineer, Air Conditioning and Refrigeration Division. Mr. Lancaster joined the Research Department at Worthington in 1940. Mr. Ewer joined the Carbondale Machine Co. after his graduation from Stevens Institute of Technology in 1907. When Worthington purchased the Carbondale Machine Co. in 1934, Mr. Ewer was named chief engineer, in which capacity he has served until the present time.

• Stewart E. Lauer was re-elected president of York Corporation at the annual meeting of the company's board of directors. He was first elected president of the air conditioning and refrigeration firm in 1940. At the same session all other company officers were re-elected.

• The Newcomen Medal, given only three times before in the history of the U. S. branch of The Newcomen Society, was awarded in January to William H. Rowand, vice president of The Babcock & Wilcox Co. of New York, at a joint meeting of the Society and The Franklin Institute, in honor of Benjamin Franklin's birthday. Previous recipients of the award for achievement in the field of steam, were Rear Admiral Harold G. Bowen, in 1944; Everett G. Ackart, 1947; and Isaac Harter, 1950. Foremost among Mr. Rowland's contributions to steam progress, which led to his nomination for the medal, was his invention in 1936 of the cyclone steam separator. This device effected a thorough separation of steam and water in boiler drums assuring circulation of boiler water even at very high pressures. It also acted to provide consistent and uniform delivery of clean, dry steam. He was also active in the subsequent development of higher temperature and higher pressure boilers which this invention made possible.

• Art DePuy, formerly manager of Minneapolis-Honeywell Regulator Company's sales office in Detroit, has been named head of a newly created trade division to coordinate expanding activities within the company's Heating Controls Division. Mr. DePuy will be headquartered in Minneapolis and will have responsibility for coordinating policy, planning and personnel requirements of the wholesaler, home builder and dealer markets.

• W. D. Sullivan has been elected a vice president of The Babcock & Wilcox Company and placed in charge of the manufacturing department of the company's Boiler Division. Mr. Sullivan was formerly regional manager of the manufacturing department.

• In a move to further diversify its manufacturing operations and to establish a west coast operation for the manufacture of its standard products, American District Steam Co., Inc., of North Tonawanda, New York, has acquired the business of the California Steel Products Co., Richmond, Cal., manufacturers of heat exchangers, industrial storage water heaters, boilers, plate and structural items. Operation at California Steel Products will continue under the direction of Mr. G. F. Bont and his present organization.

• Harry C. Ballman has been appointed executive secretary of the Air Pollution Control Association. In this position Mr. Ballman is the senior incumbent of the Air Purification Fellowship maintained in Mellon Institute by the Association. In 1947 Mr. Ballman joined the Indianapolis Board of Air Pollution Control as assistant combustion engineer. A year later he took up residence in Richmond, Va., as the city's smoke regulation engineer. When Columbus made a similar offer in 1949, he accepted in order to return to his home state.

• Robert S. Rickabaugh, Tuttle & Bailey, Inc., New Britain, Conn., is the new president of the Convector Manufacturers Association, succeeding Ray O. Reeves of Airtherm Manufacturing Company, St. Louis. At the annual meeting of the Association in the Hotel Cleveland, Cleveland, O., Mr. Reeves was named vice-president for the coming year and George W. McCormick, Jr. was re-elected secretary-treasurer with offices at the headquarters of the association in the Guardian Building, Detroit.

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COME BETTER FANS FOR YOU

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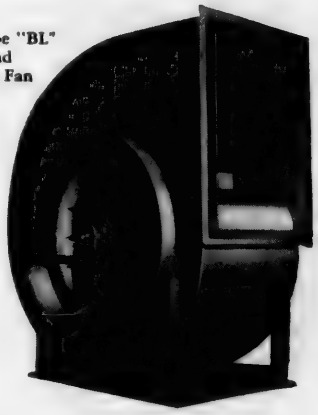
Axial Flow Fan

"Buffalo" Type "BL"
Limit-Load
Ventilating Fan



• To be sure that "Buffalo" rotors can stand far greater stress than they would ever encounter in an installation, we deliberately try to destroy them in this "Buffalo" vacuum test pit! Here, in a partial vacuum, the rotor to be tested can be revolved at tip speeds as high as 60,000 and even 70,000 feet per minute. The slightest unbalance, the slightest structural weakness, would result in destruction of the rotor at these fantastic speeds — and it shows up here in the Punishment Pit, not in the installed fan.

This is just one phase of the rigid testing and excellence of engineering, or "Q" Factor*, which assure you of a best buy when you specify "Buffalo" Fans. Why not write for "Buffalo" engineering literature on *your* air handling problem?

•

**The "Q" Factor — The built-in Quality which provides trouble-free satisfaction and long life.*

"Buffalo"

BUFFALO FORGE COMPANY

480 BROADWAY BUFFALO, NEW YORK

Publishers of "Fan Engineering" Handbook

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Sales Representatives in all Principal Cities

ILATING PRESSURE BLOWING AIR CLEANING COOLING AIR TEMPERING HEATING INDUCED DRAFT FORCED DRAFT EXHAUSTI

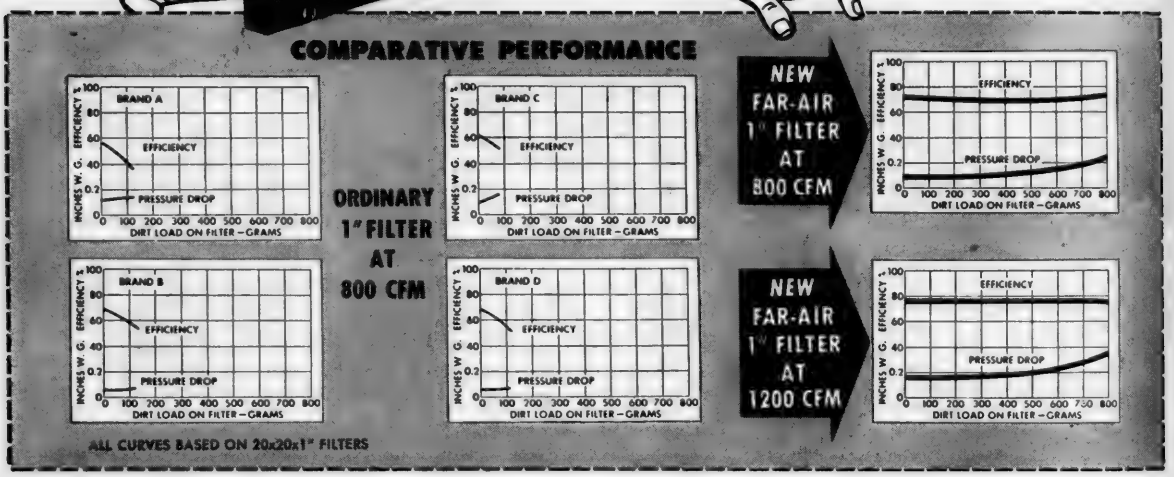
Here's Your Proof!

NEW FAR-AIR®
High-Low Velocity 1" FILTER

—holds 7 times as much dirt as ordinary filters

—gives sustained high performance with low pressure loss

—can be used at either high or low velocity



These graphs show actual performance of the new FAR-AIR High-Low Velocity 1" Filter as compared to performance of ordinary types under identical conditions. In addition, it delivers half-again as much clean air because of 50% greater capacity.

Permanent, scientifically designed and ruggedly built, it eliminates the necessity for never-ending replacements. No longer need you put up with poor performance as ordinary 1" filters approach the useless point.

Because it loads progressively, it gives you high efficiency air filtration without critical pressure loss right up to cleaning time. Cleaning is simple and easy. With reasonable care it will last indefinitely.

Here at last is the new-type filter all industry has been waiting for. It means higher quality performance from ⅓ less space, with literally negligible service requirements.

Eliminate the wasteful expense of inefficient filters —save time and trouble—get better air filtration at lower cost. Write today for complete information. Farr Company, P. O. Box 10187, Airport Station, Los Angeles 45, California.

ORIGINATORS OF FAR-AIR CERTIFIED FILTER SERVICE

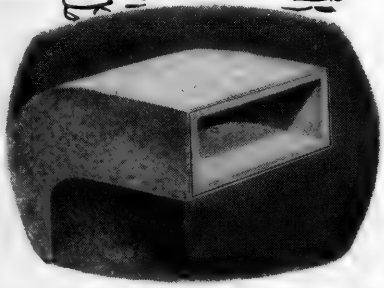
FARR COMPANY

NO COMPROMISE ON QUALITY

Los Angeles, New York, Chicago, Memphis

MANUFACTURED UNDER LICENSE BY FARR COMPANY MANUFACTURING LTD., MONTREAL, CANADA

Better by FARR — Better buy FARR



Just for the want of a little

ULTRALITE Duct Liner . . .

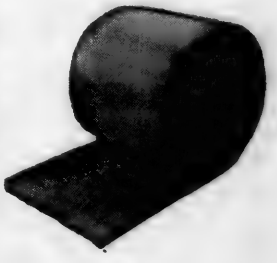
. . . customers lost their patience, the store manager nearly lost his mind—and the people who installed the air conditioning system nearly lost the good will of the store.

Here's what happened: The store's "specs" did not call for duct liner. The sheet metal contractor called this oversight to the store's attention and recommended Ultralite glass fiber Duct Liner. But the store felt that the additional cost, while small, was not necessary.

Came the Grand Opening of the modernized store —with the results pictured above. Of course, the contractor received an urgent call-back. He quickly solved the noise problem with Ultralite Duct Liner A happy ending—except that it cost the store several times as much as if they had originally lined the ducts with Ultralite!

Moral: Urge every customer not to be pennywise and pound foolish about duct liner. See that Ultralite Duct Liner is in all your air conditoning specs. From a cost standpoint, Ultralite is just a small portion of the total cost—but it can make all the difference between an enthusiastic customer and a disgruntled one. That's why many contractors put Ultralite Duct Liner in every job—*even those where duct liner is not specified.*

Ultralite is the only insulation made of long-strong glass fibers. Easy to install, pleasant to handle. Ultralite Duct Insulation (for thermal protection) and Ultralite Duct Liner are stocked locally in 72 cities. Your nearby distributor is listed in the Yellow Pages under "Gustin-Bacon" or "Ultralite."



GUSTIN-BACON MANUFACTURING CO.
222 W. 10th St., Kansas City, Mo.

New York • Chicago • Philadelphia • San Francisco • Los Angeles • Houston • Tulsa
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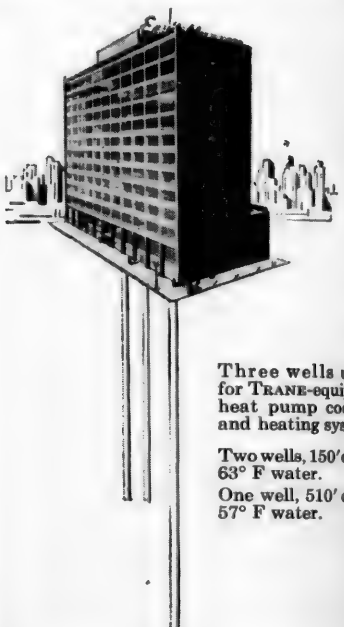
Trane heat pump sets

Engineers of Portland's 12-story provides heat for only 16%



Three wells used for TRANE-equipped heat pump cooling and heating system.

Two wells, 150′ deep, 63° F water.

One well, 510′ deep, 57° F water.

Trane CenTraVac, refrigeration compressor from 50 to 400 tons, is ideal for heat pump or standard cooling jobs. *Cuts power* costs, automatically adjusts to load from 10% to 100% capacity. *Saves labor*—no attendant needed. *Simplifies installation*—no special base or sound-proofing required.

one source

new economy record!

Equitable building report heat pump of district steam costs!

- If district steam had been used for heating, total year-'round *heating-cooling* costs would have been *64% greater.*
- A total of 37% of the entire heating need was met with "*by-product*" heat —heat salvaged from the cooling process during those periods when heating and cooling were both required.
- Combined heating and cooling costs were 11.3 cents per sq. ft. (*less than half* the average for air conditioned office buildings in the U.S.)

These are findings reported by the installation's designer, J. Donald Kroeker, consulting engineer—as taken from a recent report to the A.S.H.V.E. and published in the November, 1953, issue of Heating, Piping & Air Conditioning.

This outstanding economy record was set by a 540-ton year-'round heat pump. A complete TRANE installation, including 4 hermetic centrifugal compressors, fans, coils and circulators.

The installation fully exploits Portland's low electrical rates, availability of well water at two temperatures from 57° to 65°, relatively mild climate and other favorable factors. While these conditions are not generally so favorable in most areas, your investigation of the heat pump for year-'round air conditioning may save thousands of dollars per year.

The New Trane CenTraVac— heart of an efficient heat pump installation

Fundamental to a low-cost operation in any heat pump installation is the system's ability to closely match power input to widely varying load conditions. The new TRANE CenTraVac (current model of the TRANE Centrifugal Compressors used in the Equitable job) has automatic, *continuously-variable* capacity control from 10% to 100%. This limits power use to the load requirement for outstanding economy.

Completely automatic CenTraVac permits unattended operation

The fully automatic design of the TRANE CenTraVac leaves the system supervisor free for other duties. The only *hermetic* centrifugal refrigeration unit on the market, its exclusive design eliminates shaft seals . . . frequent cause of breakdowns. Direct drive eliminates noisy, power-wasting gear boxes.

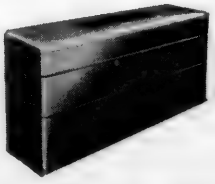
One source — One responsibility

The complete TRANE line of matched cooling-heating products simplifies design, procurement, follow-through. You have *one* source, *one* responsibility, and the ready cooperation of the largest group of technically-trained sales engineers in the industry.

See your TRANE Sales Office or write TRANE, La Crosse, Wis. Just ask for CenTraVac Bulletin DS-399.

Trane Unit Air Conditioners For Any Need

Climate Changers heat, cool, humidify, dehumidify, filter air. Multi-zone models provide up to 6 (or more) zones with different climates at the same time.



UniTrane room air conditioners give more year-'round comfort air conditioning for less money. Save space. Can save cost of central ventilation system.

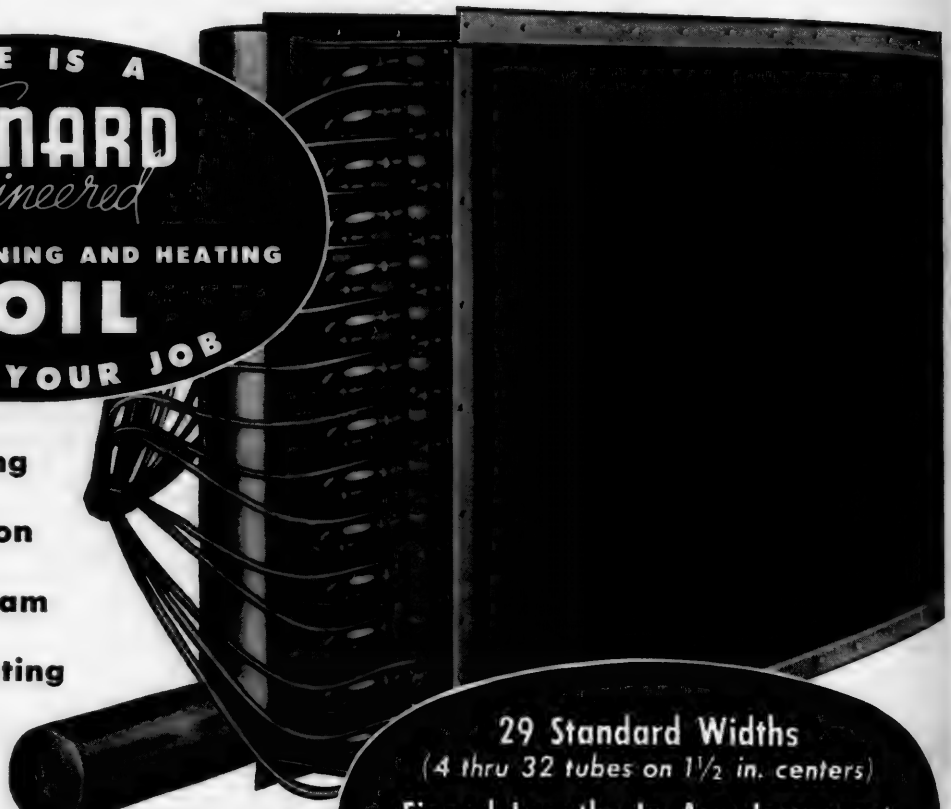
...one responsibility TRANE

MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING AND VENTILATING EQUIPMENT

The Trane Company, La Crosse, Wis. • East. Mfg. Div., Scranton, Penn. • Trane Co. of Canada, Ltd., Toronto • 87 U.S. and 14 Canadian Offices.

you can get it at KENNARD!

THERE IS A
KENNARD *Engineered*
AIR CONDITIONING AND HEATING
COIL
TO DO YOUR JOB



Heating-Cooling

Direct Expansion

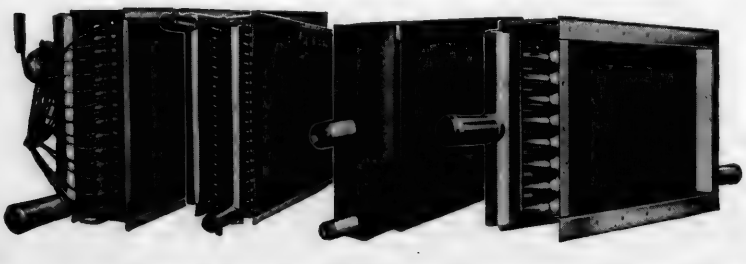
Water and Steam

Steam Distributing

29 Standard Widths
(4 thru 32 tubes on 1½ in. centers)
Finned Lengths In Any Increment
(up to 10 ft.)
Any Number of Rows Deep

Flexibility to meet exacting needs is yours when you specify or order Kennard Engineered Coils.

Plus... Hard temper fins, permanently bonded by hydraulic expansion of tube.
High temperature brazing of all tube joints.
Aluminum or Hot-Dipped Galvanized Steel Frames.



EVERY KENNARD REPRESENTATIVE was selected for his know-how and ability to help you solve your air conditioning problems. He's probably your neighbor—write us for name of one nearest you.

KENNARD CORPORATION • 1823 S. HANLEY ROAD
ST. LOUIS 17, MO., U.S.A.

Quiet AS A MOUSE!

DETROIT V-579 "BI-FLEX"

The Quiet-Acting GAS VALVE—Performance Proven for Reliable Service on Thousands of Installations!

Check These Features

- Quiet operation—no click, no hum
- Rugged, compact—easy to service
- Inexpensive
- For all gases in all localities
- "Bi-flex" motor operated—low voltage
- Compensated for changes in ambient temperature
- Snap-acting opening and positive closing
- ½-inch to 1¼-inch sizes

Here is a gas valve which is actually quiet in operation! Its strong "Bi-flex" motor provides unfaltering opening and tight shut-off closing with absolutely no annoying, worrisome bangs, clicks or hums. Thousands of installations have proved its unsurpassed reliable, trouble-free performance. Simple in design, positive in operation, the V-579 operates independently of gas pressure and is available in sizes to fit any domestic heating system. Write today for Bulletin No. 229.

NO. 411—*the sensitive and accurate Timed Cycling Thermostat for all types of heating systems. Provides close control of room temperature. Attractively styled, easily installed and adjusted. Write for Bulletin No. 193 and Form No. 1545-A.*

DETROIT CONTROLS *Corporation*

5900 TRUMBULL • DETROIT 8, MICHIGAN

Division of American Radiator & Standard Sanitary Corporation

Representatives in Principal Cities • Canadian Representatives in Montreal, Toronto, Winnipeg—Railway and Engineering Specialties, Ltd.

AUTOMATIC CONTROLS for REFRIGERATION · AIR CONDITIONING · DOMESTIC HEATING · AVIATION · TRANSPORTATION · HOME APPLIANCES · INDUSTRIAL USES

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AMERICAN-STANDARD · AMERICAN BLOWER · CHURCH SEATS & WELL PUMP · DETROIT CONTROLS · KEWANEE BOILERS · ROSS EXCHANGERS · SUNBEAM AIR CONDITIONERS

POWERS *NEW* Unit Ventilator Control System

and now,

POWERS

offers another advance in

UNIT VENTILATOR TEMPERATURE CONTROL

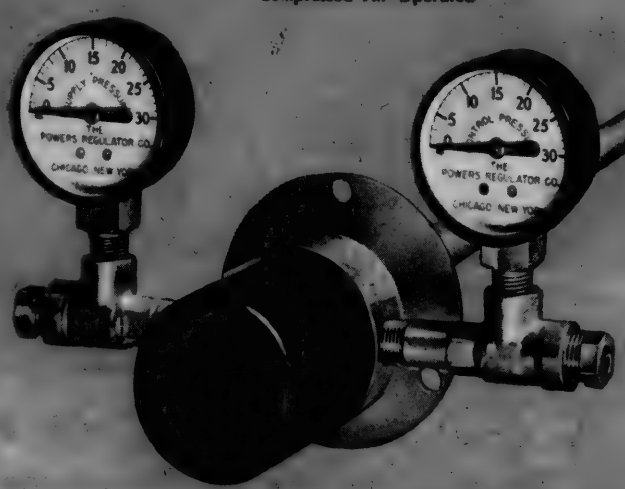
Gives More Accurate Control with LESS Maintenance

It's New!

LIMITEM

LOW-LIMIT AIRSTREAM THERMOSTAT

Compressed Air Operated



A *Precision Instrument* engineered to provide control for Unit Ventilator discharge temperatures — a critical requirement for classroom comfort.

POWERS ROOM THERMOSTATS

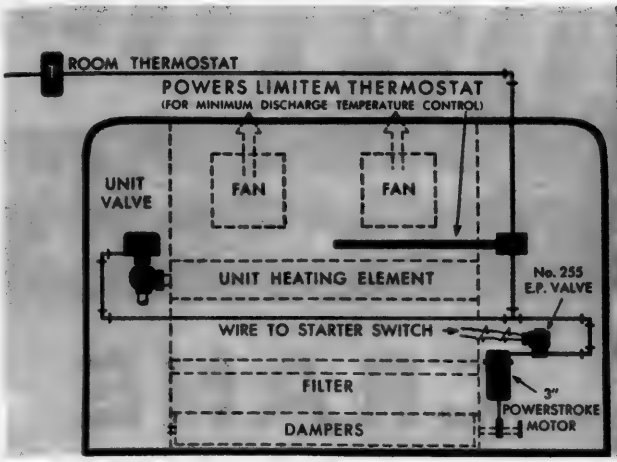
are truly gradual-acting and give smooth control of valves and dampers. Day-Nite Thermostats with automatic change-over are available when required.

POWERSTROKE DAMPER OPERATOR

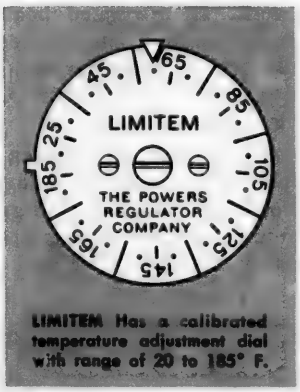
with hesitation spring gives smooth gradual operation of unit ventilator dampers.

Eliminates OVER-heated Classrooms...

... INSURES UTMOST COMFORT AND FUEL ECONOMY



POWERS Temperature Control for Unit Ventilators



LIMITEM Has a calibrated temperature adjustment dial with range of 20 to 185° F.

... with its simple, direct control gives close regulation without using complicated auxiliary devices. Thermostats, packless valve and damper operator are all engineered to give many years of reliable, trouble free service.

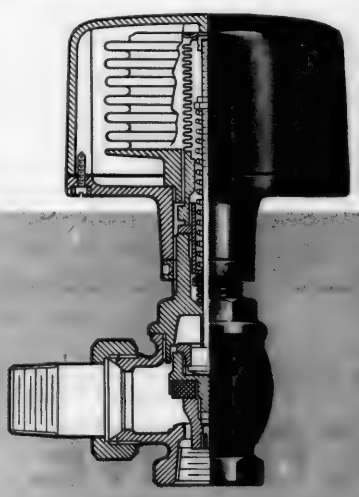
New LIMITEM Thermostat is the most accurate instrument made for low-limit control of unit ventilators It incorporates such sound engineering principles as: Sturdy construction, Accurate Response, Ingenious non-bleed double air valve to insure stable control with low hysteresis and Adjustable Sensitivity to give precise throttling range.

POWERS PACKLESS Control Valves are now standard for unit ventilators and convectors. You get a really modern temperature control system when you use POWERS.

Contact your nearest Powers Office for engineering data and ask to see the new LIMITEM low-limit thermostat.

No More Steam or Water Leakage

No More Packing Maintenance



POWERS Valves Are Carefully Sized for Each Unit.

POWERS SPECIAL UNIT VENTILATOR CONTROL VALVES

Their **PACKLESS** construction reduces valve stem friction, eliminates packing maintenance and gives smooth control. High lift poppet provides 3 times as much travel (for a ½" valve) as compared with previous valves. Characterized throttling plug insures correct flow of steam or water over the full range of valve travel and is particularly effective at low capacity requirements—the most critical point.

THE POWERS REGULATOR CO.

Skokie, Ill. • Over Sixty Years of Automatic Temperature control

Offices in over 50 Cities in U.S.A., Canada and Mexico • See Your Phone Book

(b60)

SAFE CONTROL

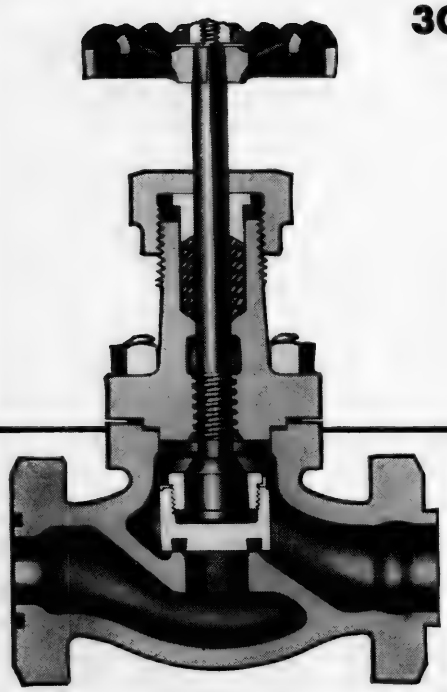
for ammonia and other hard-to-handle fluids

CRANE

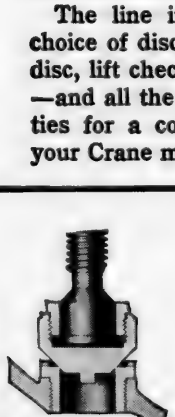
300-pound heavy-duty all-iron valves

Put these Crane valves to the test—use them for ammonia, air, oil, gas, caustic solutions, chlorinated compounds, alcohols —for chemicals and process work. Their rugged bodies of Ferrosteel (35% stronger than cast iron) . . . their precision seating designs . . . the unusually deep stuffing box and high-grade packing . . . the sweeping interior body contours . . . assure the safety and lasting service you want.

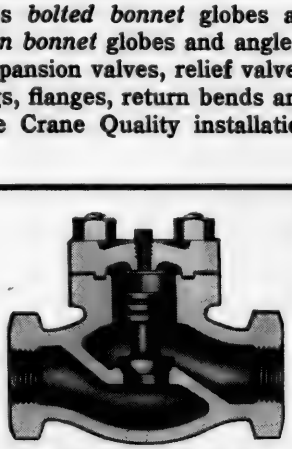
The line includes *bolted bonnet* globes and angles with choice of disc, *union bonnet* globes and angles with plug-type disc, lift checks, expansion valves, relief valves, liquid gauges —and all the fittings, flanges, return bends and other specialties for a complete Crane Quality installation. Check with your Crane man.



Cross-section bolted bonnet Globe, with flanged ends and special lead-faced disc. Sizes ¼ to 4-inch.



Bolted bonnet Globes also available with steel disc and seat where high temperatures or corrosion prohibit use of lead.



Cross-section, Lift Check with bolted cap, and cushioned disc action which increases valve life. Sizes ½ to 2-inch.

New 6-page folder AD1977 catalogs this complete Crane line. Write direct, or ask your Crane Representative.

THE BETTER QUALITY . . . BIGGER VALUE LINE . . . IN BRASS, STEEL, IRON

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

Hotel Saves 17% *with Anemostat High Velocity Air Conditioning System*

The Kentucky Hotel, Louisville, Ky., lost no room rentals during installation of its High Velocity air conditioning system.

There were three bids for the High Velocity air conditioning system for the Kentucky Hotel in Louisville. The Anemostat High Velocity System was selected at an overall saving of 17% over bidder number two, and 20% over bidder number three.

Anemostat's High Velocity System has the widest range of application for both alteration jobs and new construction. Write for HV Manual 48.

ANEMOSTAT®

DRAFTLESS *Aspirating* AIR DIFFUSERS

ANEMOSTAT CORPORATION OF AMERICA

10 EAST 39th STREET, NEW YORK 16, N. Y.

REPRESENTATIVES IN PRINCIPAL CITIES

"No Air Conditioning System Is Better Than Its Air Distribution"

BARBER COLMAN

ELECTRIC

Automatic Controls

...provide individual room temperature controls for guests at BRIKCRETE MOTEL in Grand Rapids, Michigan

Architects (for original building) Gerald Diekema, Grand Rapids, Michigan; (for addition) Alwin S. Kolm, East Lansing, Mich. Heating Contractor: Knee Heating Company, Grand Rapids, Mich.

14-room addition to Brikcrete Motel, completed in 1953. Each room has its own Barber-Colman Thermostat, permitting each guest to adjust the temperature to his needs.

Smart, modern Brikcrete Motel in Grand Rapids attracted so much traffic a fourteen-room addition became necessary. Original building shown above houses lobby, office, and eleven guest rooms, plus manager's quarters on second floor. Zone control in this building will be changed to individual room control as used in new addition (right)

Restful main lobby of this unique motel provides guests with comfortable seating arrangements, plus television. Entire motel is constructed of Brikcrete, called "the world's most modern masonry."

Simplest possible type of heating control was installed in this excellent example of present-day motel design. Individual room thermostats, motor-operated valves, and a power box are combined in an electrical system which has proved highly satisfactory. As Mrs. Degi, manager, states: "The individual control of heat in each room allows our guests to select the temperature they like best. It also allows us to turn off the heat in unused rooms during our slack season. We are impressed with the efficiency of operation and hope to install Barber-Colman units in our original building." Moreover, Mrs. Degi is considering a central time clock for reducing heat supply during sleeping hours, when many windows are open.

Flexible Barber-Colman electric controls solve a wide range of heating, cooling, and ventilating problems efficiently and economically. Phone your nearest Field Office or write for expert engineering help on *your* application.

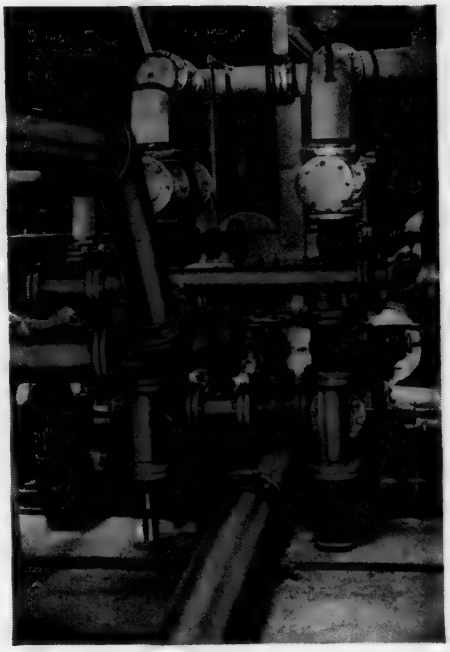
BARBER-COLMAN COMPANY, ROCKFORD, ILL., U.S.A.

Dept. C, 1302 Rock St. • Field offices in principal cities

Automatic Controls • Air Distribution Products • Industrial Instruments • Aircraft Controls • Small Motors • Overdoors and Operators • Molded Products • Metal Cutting Tools • Machine Tools • Textile Machinery

Color-personalized guest rooms have attractive, modern appointments, including adjustable control of heat radiated from baseboard. Mrs. Marie Degi, manager, adjusts Barber-Colman Thermostat mounted on soundproof wall.

Oil-fired boiler provides hot water (two-pipe system) for heating, washing, bathing, and laundry facilities. Barber-Colman equipment illustrated provides simple, dependable, individual room comfort. Inside Power Box Cabinet are a transformer, disconnect switch, and an overload circuit breaker.



Quick Quiz

on copper piping

Q A **Isn't copper tubing more expensive to use than piping made of other materials?**

In some cases, yes. In most cases, no. There are many conditions under which ANACONDA Copper Tube proves to be the *least* costly piping obtainable. Prevention of rust, corrosion and contamination, together with the lower labor costs of installing solder-type fittings, often more than offset differences in piping material cost.

Q A **Why is copper tube easier to install?**

There are many reasons. First, ANACONDA Copper Tube is light, easy to handle. Second, it comes in longer lengths, which saves cutting and fitting. Third, it is more flexible, can be bent on the job—again saving cutting and fitting. Fourth, required connections are fast and easy to make. No threading.

Q A **Are changes in piping systems hard to make where copper tubing is used?**

Definitely no. Once installed, copper tubes connected with solder fittings can be taken down, moved, or have new connections cut in faster and with less expense than with threaded pipe.

Q A **Where can I get more facts?**

A well illustrated booklet, "ANACONDA Copper Tubes for Industrial Applications," is available on request. It contains a wide range of information on copper tubes, their applications, advantages and installation. Numerous reference tables useful to user and installer are also included. For a copy of this booklet, ask for Publication C-24 and send your request to The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

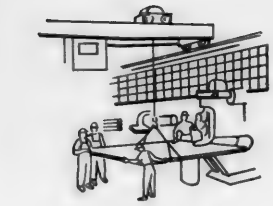
for better piping...use **ANACONDA®**

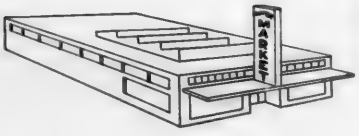
COPPER TUBES

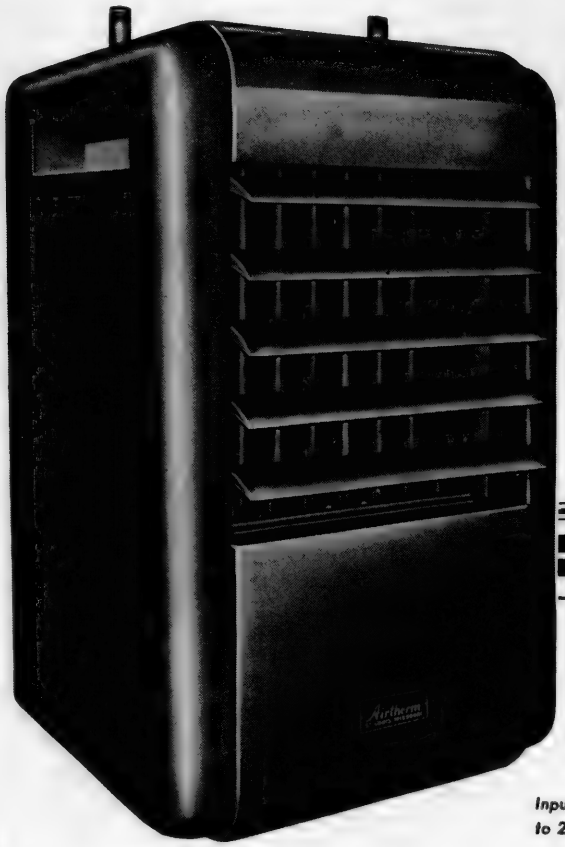
Put Heat Where You Need It . . .

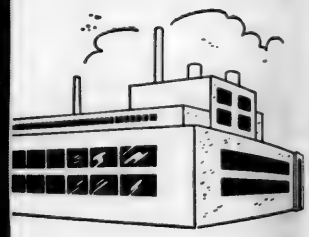
Easily and Economically

with *Airtherm* GAS UNIT HEATERS









Input 25,000 BTU to 200,000 BTU

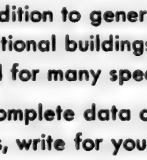
These attractive, self-contained units now give you new freedom and flexibility in laying out heating systems. For quiet, clean and completely automatic heat, they can be installed just about anywhere you can run a gas pipe.

In addition to general heating in commercial, industrial and institutional buildings of all kinds, you'll find Airtherm Gas Unit Heaters useful for many special purposes, such as drying, blanketing doorways, etc.

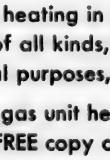
For complete data on gas unit heater installation with all types of gases, write for your FREE copy of Catalog 500.

For Heating Satisfaction . . .
Think First of

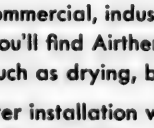
Airtherm



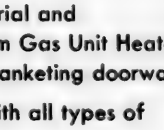
Oil or Gas Direct Fired Heaters



Horizontal Type Unit Heaters



Convectors



Vertical Type Unit Heaters

Centrifugal Fan Unit Heaters

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Whatever your specs call for on size, output, tube, construction, etc., BUSH can now supply an industrial fin to meet them. With the recent addition of a 4¼" x 4¼" fin, BUSH now offers the heating man a line of finned surface with flexibility to meet any required output.

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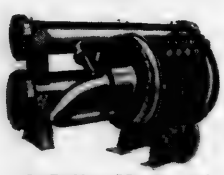
A full summer of Air

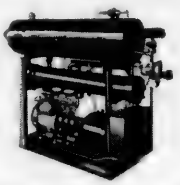
Trane UniTrane System in "world's biggest house"

Typical installation shows unit free-standing under window. In Woodner apartments, unlike this one, units are recessed, extending only 7" into room. Models are also available for concealed wall, ceiling or closet installation. In all cases, they provide true year-'round comfort. A simple small-pipe circuit supplies chilled water to each UniTrane coil for summer cooling and dehumidifying—hot water for winter heating. *All air*, not just ventilation air, is filtered in unit before passing over coil—an important TRANE feature eliminating clogged coils and maintenance expense.

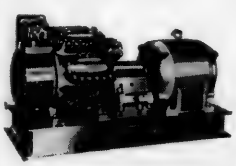
SPECIFY MATCHED TRANE EQUIPMENT FOR UNDIVIDED RESPONSIBILITY!



CenTraVac—New centrifugal water chilling system . . . sets new standards of operating efficiency. 45 to 400 tons



Cold Generator—Packaged water chiller. Completely wired, piped, refrigerant-charged at factory. 10 to 100 tons.



Reciprocating Compressors—Rugged, dependable, quiet, efficient. Automatic multi-step cylinder unloading. 6 sizes up to 50 tons.

Climate Changers—Heat, cool, humidify, dehumidify, filter. Provide up to 6 zones with different combinations. 450 to 23,400 cfm.

For information on the complete TRANE line, call your nearest TRANE office or write TRANE, La Crosse, Wis.

TRANE UniTrane

MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING AND VENTILATING EQUIPMENT

The Trane Company, La Crosse, Wis. • East. Mfg. Div., Scranton, Penn.
Trane Co. of Canada Ltd., Toronto • 87 U. S. and 14 Canadian Offices.

Engineers: General Engineering Associates, Washington D.C.

Conditioning for $7.33 operating cost per tenant!

cuts cost—gives tenants individual climate control

In the new $12-million Woodner Apartments, Washington, D. C., 3,000 tenants in 1,140 apartments were cooled during the entire sweltering summer of 1953 by TRANE UniTrane room air conditioners . . . at an estimated cost of only $22,000 for electricity and cooling tower make-up water.

Slashes power requirements: With the UniTrane system, cooling (or heating) is used only where it's needed. Individual room units can be shut off in unoccupied rooms without affecting operation of any of the other units. Because ventilation air is brought directly through the outside wall into each room unit, there is no central ventilation system to operate.

Result: Operating load can be matched directly to fluctuating temperature requirements for lowest possible operating cost.

Tenants like UniTrane because it places climate control completely in their hands. Occupants of any size motel, hotel, office or apartment building can have the temperature they want, in *any* room, *any time*, day or night.

Owners like UniTrane because this unique combination of tenant advantages costs less to install, far less to operate. No central ventilation system to maintain—no complicated ventilation controls are required. All air, both ventilation and recirculated, is filtered at the unit. Rooms and decorations stay clean longer.

Architects welcome the savings in valuable floor space, design freedom. Units are available in all sizes and types—free-standing, recessed, semi-recessed, ceiling—for either exposed or concealed installation.

Engineers appreciate being able to plan full capacity for each space. They like the heavy-gauge construction, the quieter operation (each unit is sound-room tested before shipment.)

"Our 3,000 residents are delighted with the system which works well even at the worst of Washington's sweltering summer," says owner-architect Ian Woodner. "We compliment you on the quality of your installation and the soundness of its design and workmanship."

Award for outstanding new building of 1952 was presented to Ian Woodner by Washington Board of Trade. The building was judged by a distinguished panel of nationally-known architects.

Huge Woodner Apartments, Washington, D. C., has 3,000 occupants . . . cost of TRANE UniTrane year-'round air conditioning system was only $500 per room . . . summer operating cost from May 19th to October 5th 1953, was $7.33 per occupant.

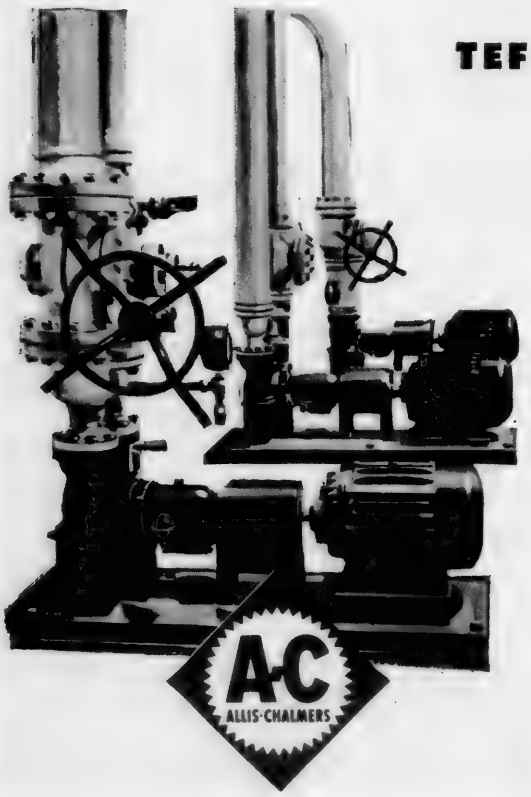
GREATER PROTECTION AGAINST FOREIGN MATTER—LONG

new motors - new

OPEN—DRIP-PROOF

Here are a few of the reasons why the new Allis-Chalmers open—drip-proof motor in NEMA rerate sizes will give you better performance and lower maintenance costs in general-purpose applications.

- Better protection against falling water and debris because cooling air inlets are on bottom.
- Long bearing life because large grease chambers provide plenty of reserve lubricant and are thoroughly sealed against foreign matter.
- Quieter operation, smoother performance.



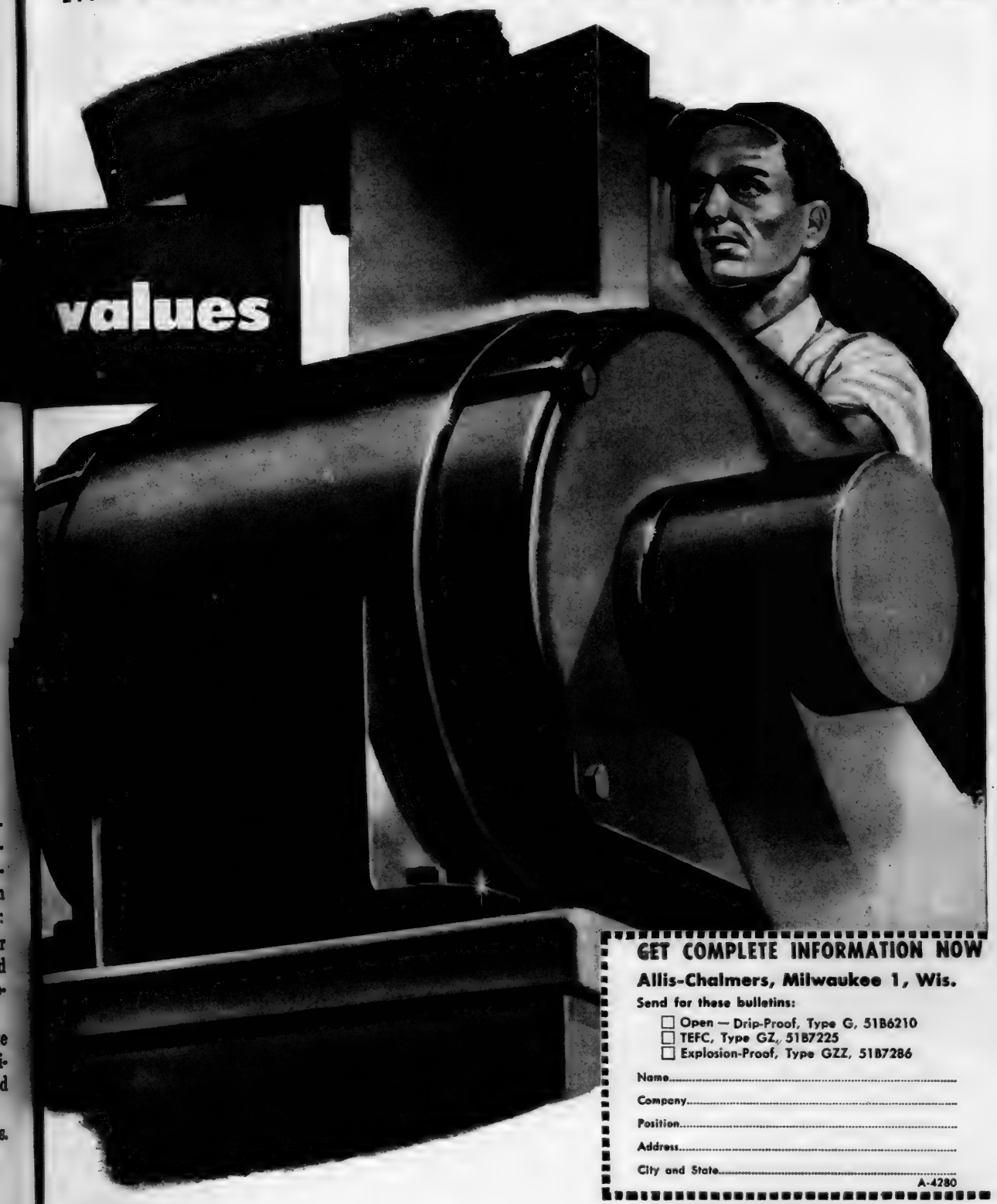
TEFC and EXPLOSION-PROOF

For especially dirty, corrosive or hazardous applications, you will get top performance with low maintenance costs from the new Allis-Chalmers totally-enclosed, fan-cooled and explosion-proof motors in NEMA rerate sizes. Here are a few of the reasons:

- Foreign matter kept out of bearings and motor interior by double labyrinth seals inside and outside of bearings, and long running fits between shaft and seals.
- Bearing maintenance reduced because large grease chambers provide space for reserve lubricant; also, if required, grease may be renewed without dismantling.
- Easy to clean — no inaccessible air passages. Dirt wipes or blows off easily.

ALLIS-

LIFE BEARINGS—MANY TRIED AND PROVEN FEATURES



GET COMPLETE INFORMATION NOW

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hot underground pipes. It's water-proo rrosio

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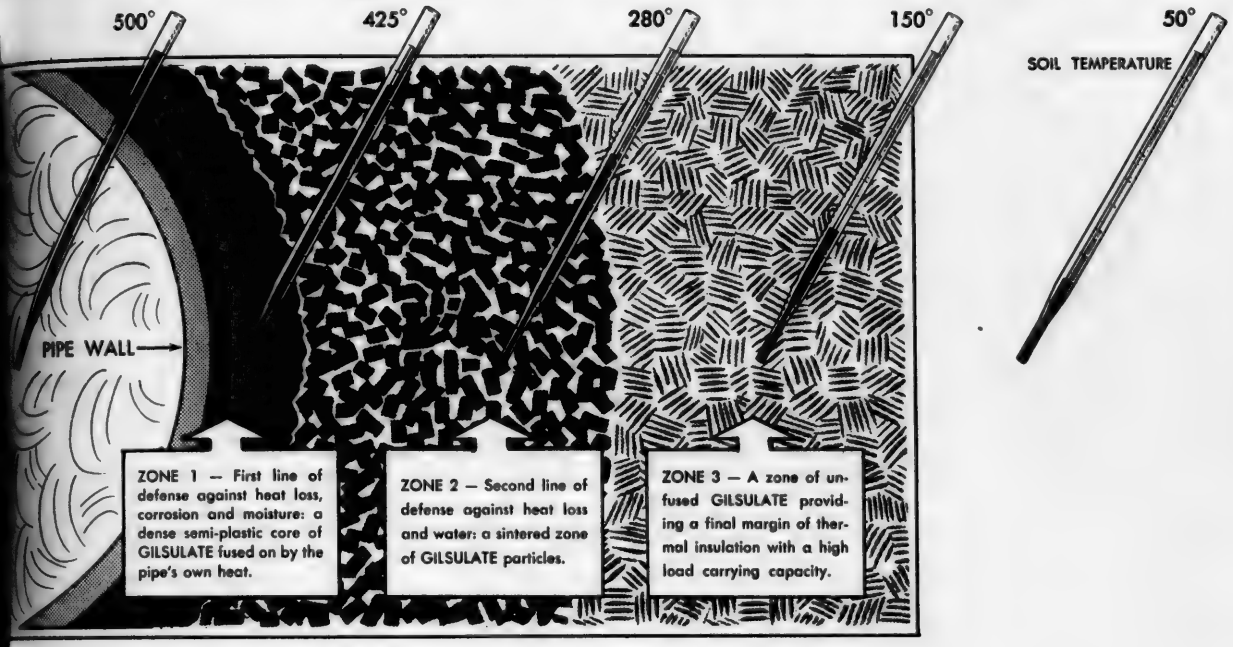
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PIPE WALL
ZONE 1 — First line of defense against heat loss, corrosion and moisture: a dense semi-plastic core of GILSULATE fused on by the pipe's own heat.
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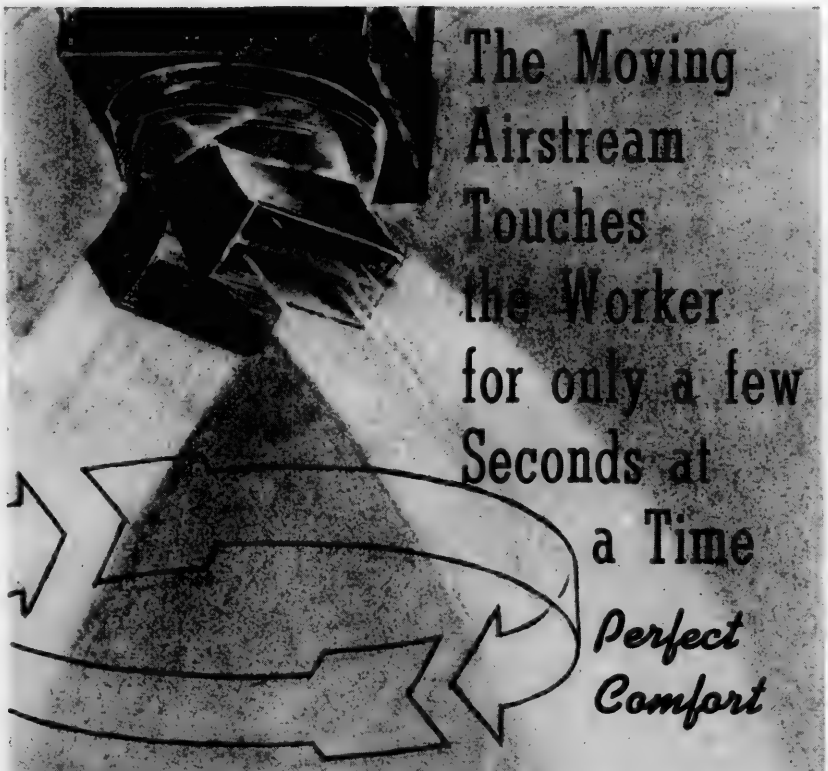

The Moving Airstream Touches the Worker for only a few Seconds at a Time

Perfect Comfort

NO SICKENING HOT BLAST!

THAT is the big difference between most unit heaters and the WING Revolving Heater. The soft airstream from the slowly revolving discharge outlets creates a warm, gentle, yet live sensation of comfortable well-being that is without equal for keeping workers contented and productive.

. . And in the Summer time with the steam turned off and the fans on, these same revolving discharge outlets will create a pleasing, cooling effect on the hottest days.

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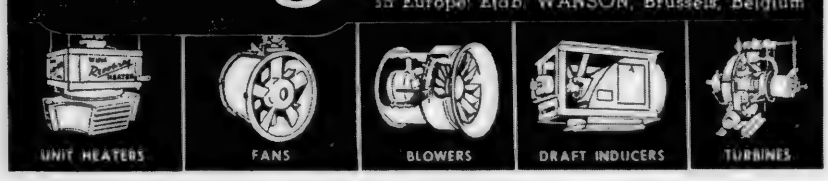

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with the WING DRAFT INDUCER

No boiler can operate satisfactorily or efficiently over wide ranges of weather or load with variable natural draft. The fuel—whether oil, gas or coal—must have enough oxygen for complete combustion. There must be sufficient draft or furnace fires will be slow burning and lifeless, resulting in uneven, insufficient and irregular heat.

WING Draft Inducers insure positive, adequate, uniform draft regardless of variable weather conditions or inadequate chimney or breeching construction.

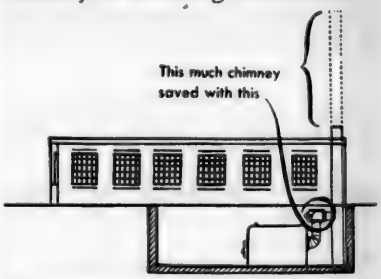
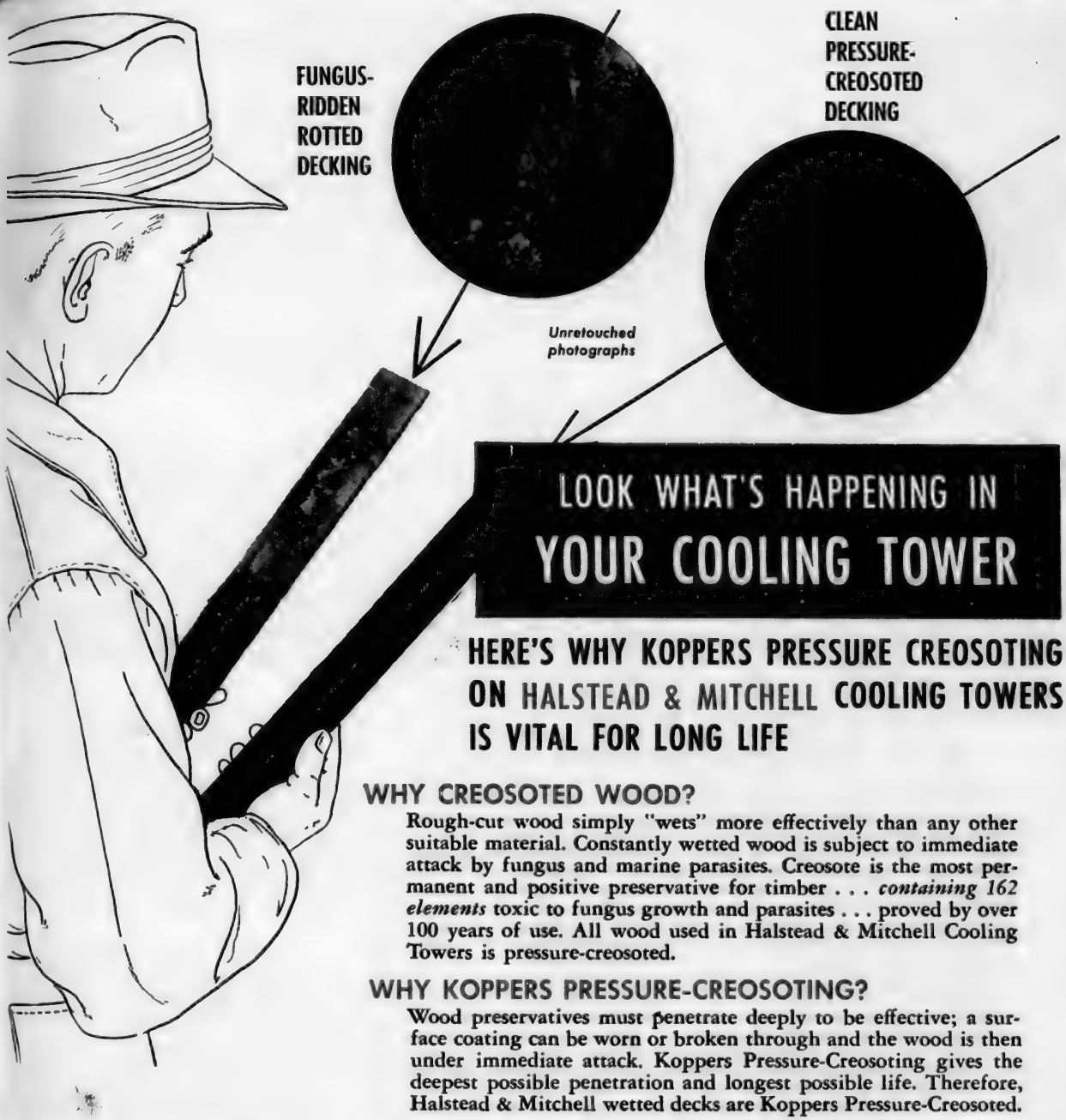


Diagram above shows how much chimney is saved by installing Wing Draft Inducers.

Wing Draft Inducers are suitable for use in connection with oil, gas, stoker-fired or hand-fired heating boilers, industrial furnaces or kilns, or high pressure steam boilers, either stationary or marine. Sizes are available for boilers as low as 1000 sq. ft. E. D. R. up to steam generators producing 100,000 pounds of steam/hr. Special, heavy duty designs available for these larger boilers.

Wing Draft Inducers are made in two types—for insertion in breeching or flue, or for installation on top of a chimney. Write for a copy of Bulletin I-52 to L. J. Wing Mfg. Co., 158 Vreeland Mills Road, Linden, New Jersey.



LOOK WHAT'S HAPPENING IN YOUR COOLING TOWER

HERE'S WHY KOPPERS PRESSURE CREOSOTING ON HALSTEAD & MITCHELL COOLING TOWERS IS VITAL FOR LONG LIFE

WHY CREOSOTED WOOD?

Rough-cut wood simply "wets" more effectively than any other suitable material. Constantly wetted wood is subject to immediate attack by fungus and marine parasites. Creosote is the most permanent and positive preservative for timber . . . *containing 162 elements* toxic to fungus growth and parasites . . . proved by over 100 years of use. All wood used in Halstead & Mitchell Cooling Towers is pressure-creosoted.

WHY KOPPERS PRESSURE-CREOSOTING?

Wood preservatives must penetrate deeply to be effective; a surface coating can be worn or broken through and the wood is then under immediate attack. Koppers Pressure-Creosoting gives the deepest possible penetration and longest possible life. Therefore, Halstead & Mitchell wetted decks are Koppers Pressure-Creosoted.

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against rotting by fungus attack

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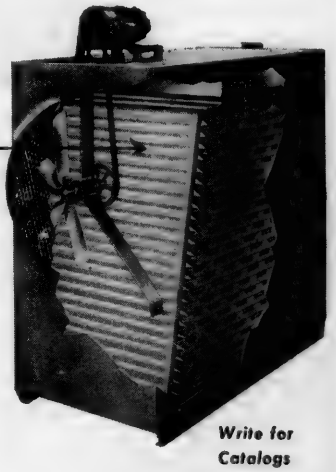

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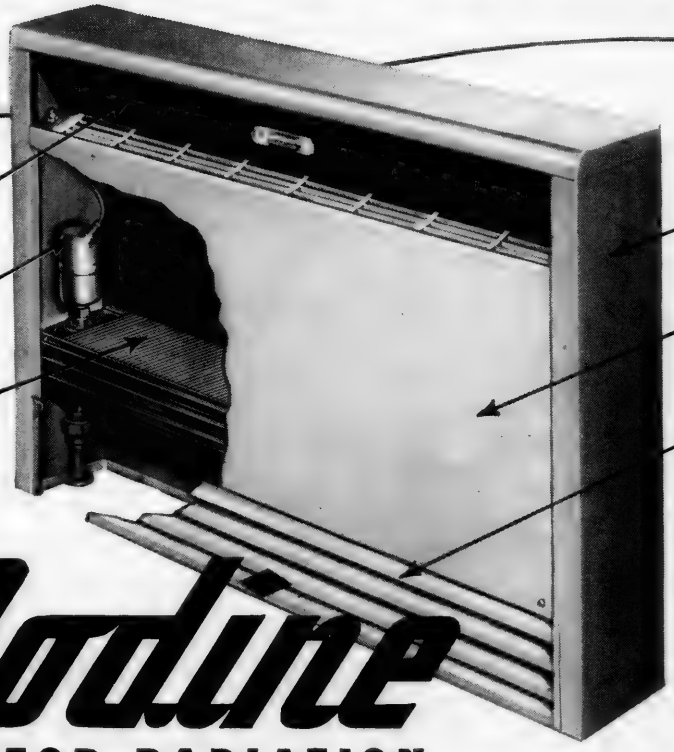

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All steam-carrying passages are copper or copper alloy . . . brazed for pressure-resisting strength.

Steel enclosure is Bonderized for rust protection, built to "take it."

Front panel is quickly removed and replaced by means of two screws for full access to unit.

Attractive lower grille (optional) snaps in or out, conceals piping.

Popular Type F illustrated. For exposed or recessed installation. Immediately available from most jobbers' stocks.

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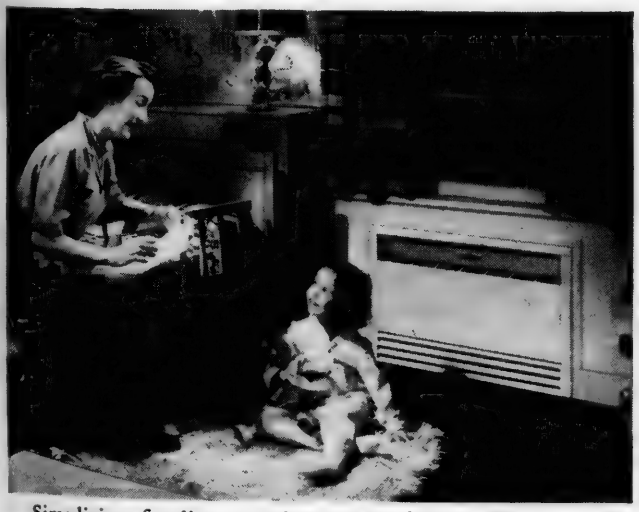
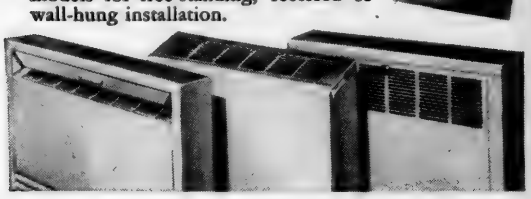


Simplicity of styling complements the beauty of both modern and traditional design, also promotes ease of cleaning.

DON'T sacrifice quality on built-in permanent heating equipment. To get the finest in modern long-life heating . . . at lower over-all costs—follow the lead of top architects and heating engineers. Choose Modine Convector Radiation. It's your assurance of many years of heating system satisfaction. For complete information, see the Modine representative listed in your classified phone book. Or for your copy of Bulletin 251, write Modine Mfg. Co., 1511 DeKoven Avenue, Racine, Wisconsin.

Choose from three enclosure types in standard and heavy-duty institutional models for free-standing, recessed or wall-hung installation.



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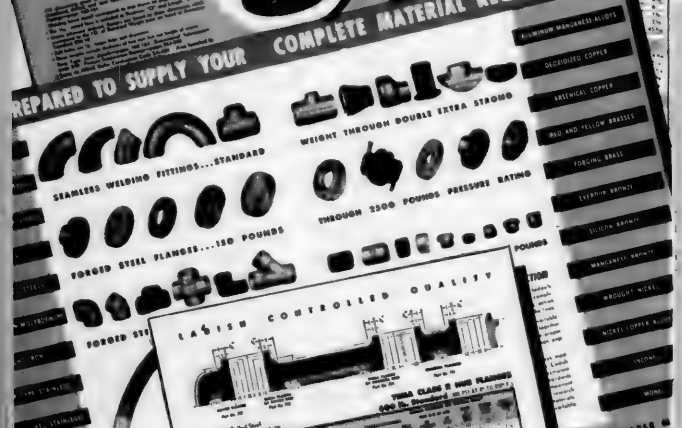

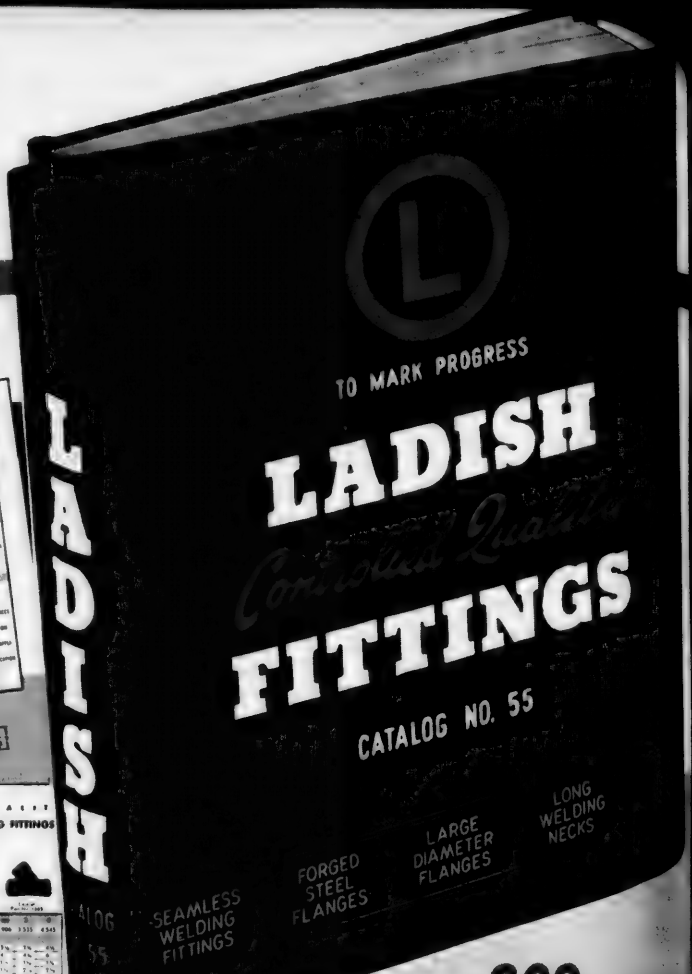

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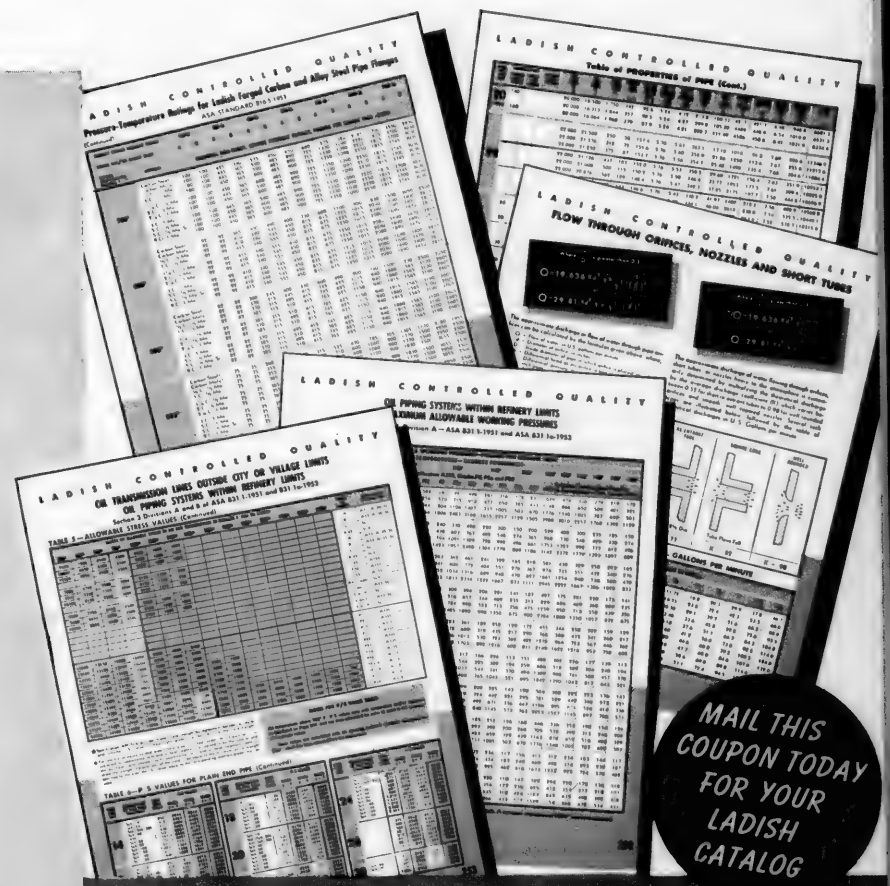
Tabulations feature new ratings for a wide range of materials for temperatures from 100° F. through 1500° F.

PROPERTIES OF PIPE

Dimensional characteristics of carbon, alloy and stainless steel pipe in commonly used nominal sizes and wall thicknesses to help solve problems of anchorage, heat loss and insulation.

FLOW THROUGH ORIFICES AND NOZZLES

Discharge through orifices, nozzles and short tubes are tabulated for a wide range of pressures up to 5000 P.S.I. and diameters from 1/64 through 1¼ inches.


LADISH CONTROLLED QUALITY
Pressure-Temperature Ratings for Ladish Forged Carbon and Alloy Steel Pipe Flanges
LADISH CONTROLLED QUALITY
Table of PROPERTIES of PIPE (Cont.)
LADISH CONTROLLED QUALITY
FLOW THROUGH ORIFICES, NOZZLES AND SHORT TUBES
LADISH CONTROLLED QUALITY
OIL PIPING SYSTEMS WITHIN REFINERY LIMITS
MAXIMUM ALLOWABLE WORKING PRESSURES
LADISH CONTROLLED QUALITY
OIL TRANSMISSION LINES OUTSIDE CITY OR VILLAGE LIMITS
OIL PIPING SYSTEMS WITHIN REFINERY LIMITS

MAIL THIS COUPON TODAY FOR YOUR LADISH CATALOG

LADISH CO.
Dept. HV, Cudahy, Wisconsin

Please send me, without cost or obligation, the new 304-page Ladish Fittings Catalog No. 55.

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Vinyl-faced Super·Fine minimizes possibility of condensation on fresh-air intake ducts. L·O·F Super·Fine's ease of application reduced installation costs for Johnson John-R Insulation Co. of Detroit.

Give your insulating jobs these advantages with L·O·F Super·Fine

Reduced installation time! — L·O·F Super·Fine insulating blankets are lightweight, pliable, easily cut, handled and installed. No special cutting tools! No time-consuming shaping or fitting! Super·Fine conforms to irregular contours or projections. The result:—easier, faster installation.

Increased over-all efficiency.—Super·Fine is superior insulation in its resistance to heat flow. Saves fuel on heating ducts, power on cooling ducts. Increases over-all efficiency of both systems. These fine glass fibers will not burn, absorb moisture, mildew or rot. Available with various types of vapor barriers for temperatures to 450° F., and with special binder for temperatures to 600° F.

Quality product backed by Libbey·Owens·Ford!—Super·Fine is backed by Libbey·Owens·Ford—long famous for outstanding glass products—your guarantee of top-quality insulation.

L·O·F GLASS Corrulux FIBER·GLASS

FIBER · GLASS

LIBBEY·OWENS·FORD GLASS COMPANY
FIBER·GLASS DIVISION

How to install Super·Fine on cooling and heating ducts

CIRCULAR DUCTS

Super·Fine conforms easily to curved surfaces. After adhesive is applied, Super·Fine is simply wrapped and secured with tying cord, light wire or staples. If staple method is followed, use in combination with adhesive. Allow sufficient overlap on larger ducts to stagger staples.

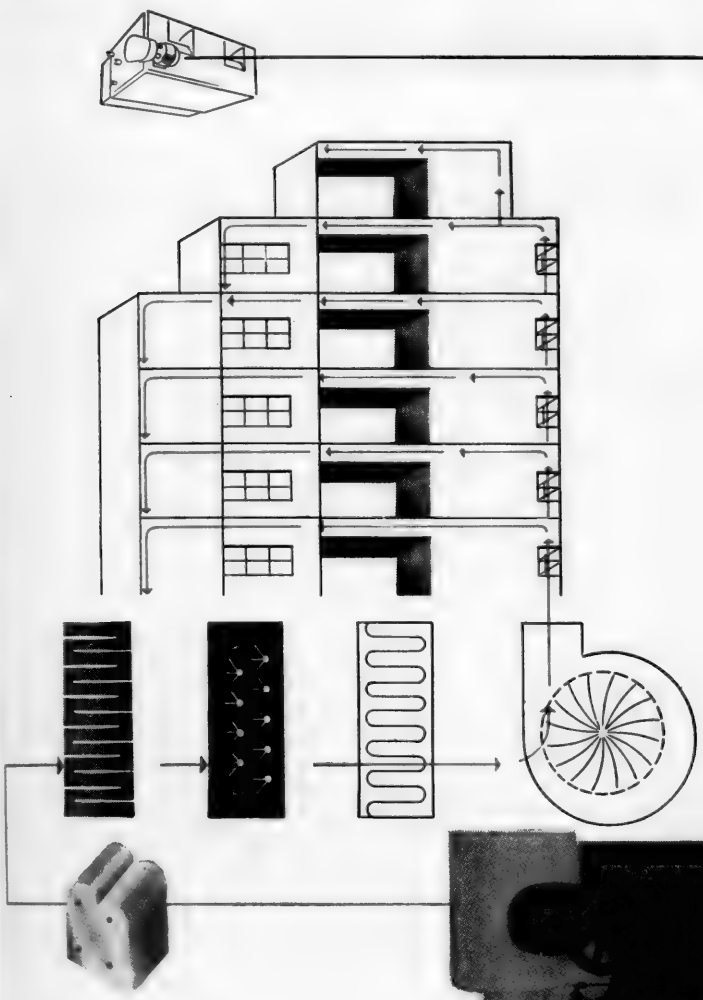
RECTANGULAR DUCTS

Super·Fine is wrapped around surface with 3" overlap. Ends can be butted or lapped. Secure with light-gauge tie-wire or Fiber·Glass tying cord or use staple method—allowing sufficient overlap on large ducts to stagger the staples. Super·Fine is also used as duct liner in air-conditioning ducts to reduce sound in middle- to high-frequency ranges.

FREE! Helpful folder gives detailed instructions for installation of Super·Fine on metal ducts. Write Libbey·Owens·Ford, Fiber·Glass Division, 3134 Wayne Building, Toledo 3, Ohio.

THE MARK OF
EXTRA DEPENDABLE
REFRIGERATION AND
AIR CONDITIONING EQUIPMENT

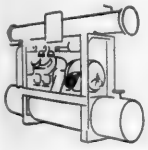
ELECTRO DYNAMIC

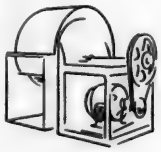


The red "power spot" on refrigeration or air conditioning equipment means *powered by Electro Dynamic*, the most dependable motors *ever* available to industry.

For *proof* of this *extra dependability* send the coupon below for your copy of **"MOTOR SHOWDOWN"**, a new candid report on comparative results of motor performance tests* conducted in accordance with A.I.E.E. standards.

*Tests certified by J. Arthur Balmford, Professor of Electrical Engineering at a leading Eastern University.





1 to 250 hp., AC and DC
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All types of enclosures

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Division of General Dynamics Corporation
151 Avenue A, Bayonne, New Jersey

ED MOTOR SHOWDOWN

Please send me a copy of "MOTOR SHOWDOWN" and the new catalog of Electro Dynamic industrial motors.

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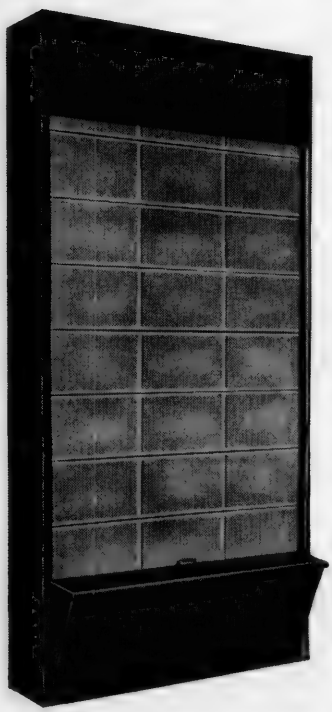
New Automaze automatic air filter keeps itself cleaner with "pulse-type" action



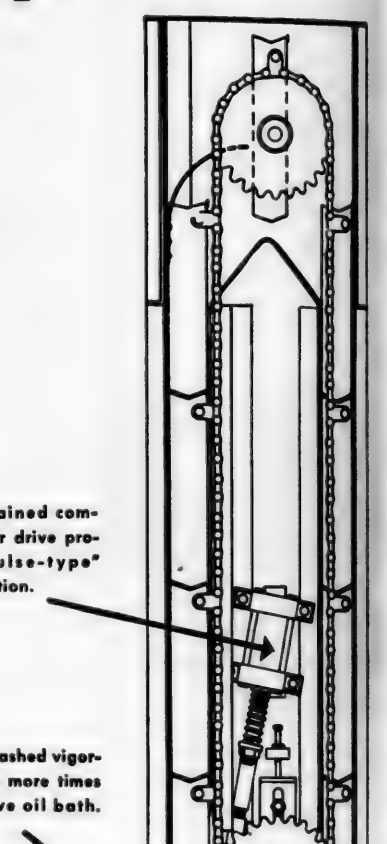
NOT ONLY does the new Automaze clean itself automatically but it keeps itself as clean as new because of its exclusive "pulse-type" action. While each panel in the revolving curtain is submerged in the cleaning tank at the bottom, it is agitated vigorously 6 or more times by a compressed air drive. This cleans each panel thoroughly, completely renews the adhesive.

Replacing stationary filters which may need cleaning once a month, the new Automaze goes 3 to 6 months without attention. And then all you need do is remove the sludge. A special reservoir cover makes this a quick, simple operation.

Filter panels two inches thick are linked in an air tight revolving curtain. Panels move up and over, like the cars on a ferris wheel. As a result, filter panels always keep the same face to the air stream. The dirty face of the filter is never on the downstream side. There's no possibility of dirt being blown off the filter into the cleaned air.

Here are a few other advantages that make Automaze today's biggest news in automatic air filtration: 1) Automaze has no electrical connections located in the air stream; 2) if desired, Automaze can be operated by remote control; 3) a variety of media designs are available to meet different filtering conditions; 4) when sections are bolted together, there's no need for rigid mechanical drive connections to cause alignment difficulties—each filter section contains its own drive mechanism.

You can get the full story from our new Automaze catalog. With over 29 years experience and thousands of different filter applications, Air-Maze, the filter engineers, are specialists in all types of air and liquid filtration. For help with your filter problems, contact your nearby Air-Maze representative or write The Air-Maze Corporation, 25000 Miles Rd., Cleveland 28, Ohio.


Self-contained compressed air drive provides "pulse-type" action.
Panel is washed vigorously 6 or more times in adhesive oil bath.

AIR FILTERS
SILENCERS
SPARK ARRESTERS

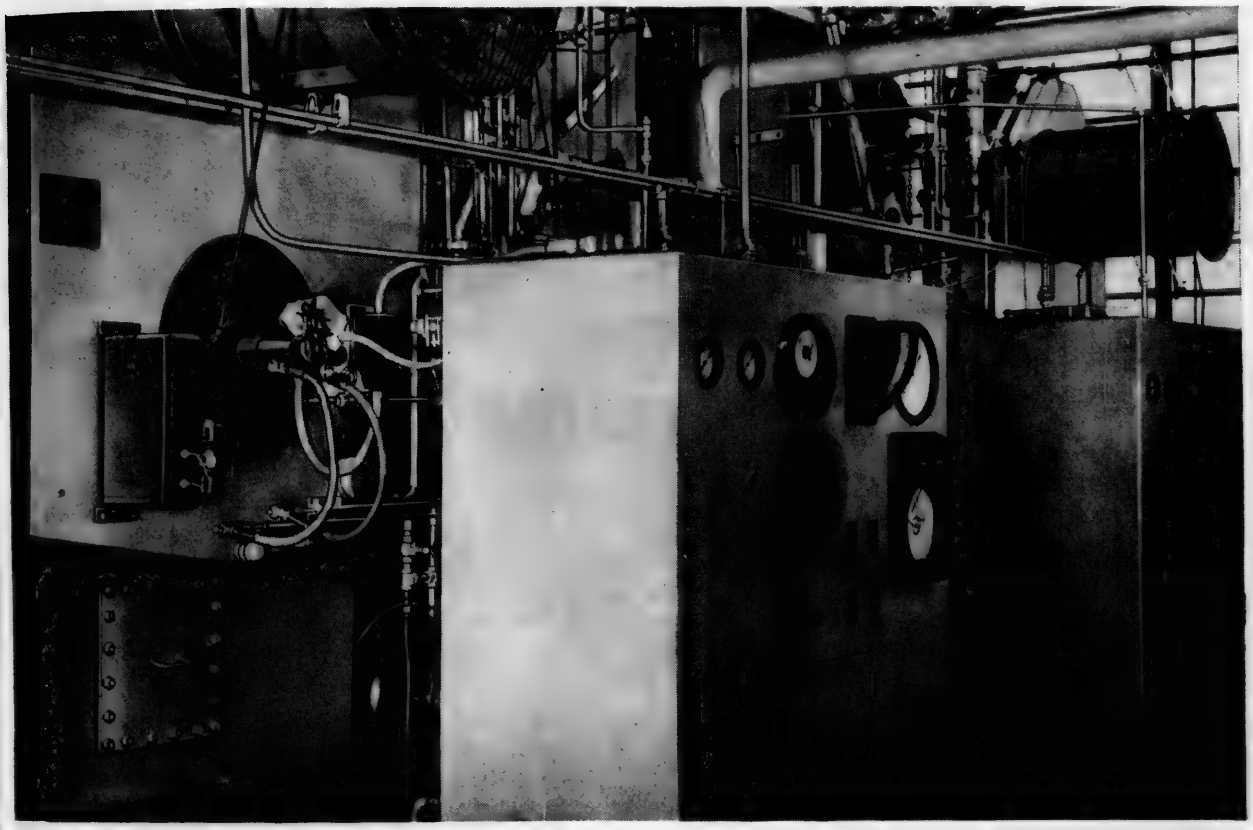
AIR-MAZE
The Filter Engineers

LIQUID FILTERS
OIL SEPARATORS
GREASE FILTERS

keeping steam cheap . . .

Rx for HOSPITALS

with the B&W Type FM Boiler



These two Type FM, B&W Integral-Furnace Boilers supply steam for all heating, cooking, and laundry requirements at a large midwestern hospital.

COST-SAVING FEATURES

- Saves Erection Time and Cost
- Meets Wide Range of Service
- Handles Quick Load Changes
- Fast Steaming
- Low Maintenance
- Easy Accessibility
- Burns Oil and/or Gas
- Saves Fuel
- Saves Space
- Safe, Automatic Operation

Among the many enthusiastic users of the shop-assembled B&W Integral-Furnace Boiler, Type FM, hospitals have found it uniquely suitable to meet their varied steam requirements. Typical of the FM Boilers now serving hospitals in various parts of the country is this dual-unit installation, which is supplying low-cost steam for all heating, laundry, and cooking requirements at a midwestern institution.

Easy to install, this compact B&W steam generator is delivered complete with firing equipment and controls . . . is ready to skid or lift into position, hook-up, and place in operation. Push-button starting and stopping and automatic handling of load variations simplify operation . . . make the Type FM Boiler ideal for small to medium-sized installations where operators have additional duties. Even for some larger installations it has been found practical and more economical to have a multiple-unit, Type FM installation rather than one or more large boilers requiring complete field erection and close operating supervision.

Available in standard sizes for loads ranging between 2900 and 28,000 lb of steam per hr at pressures to 235 psi, this efficient B&W unit is already enjoying wide popularity with users in a broad range of industrial, commercial, institutional, and other classifications . . . is in service or on order for a total steam capacity approaching 7,000,000 lb per hr.

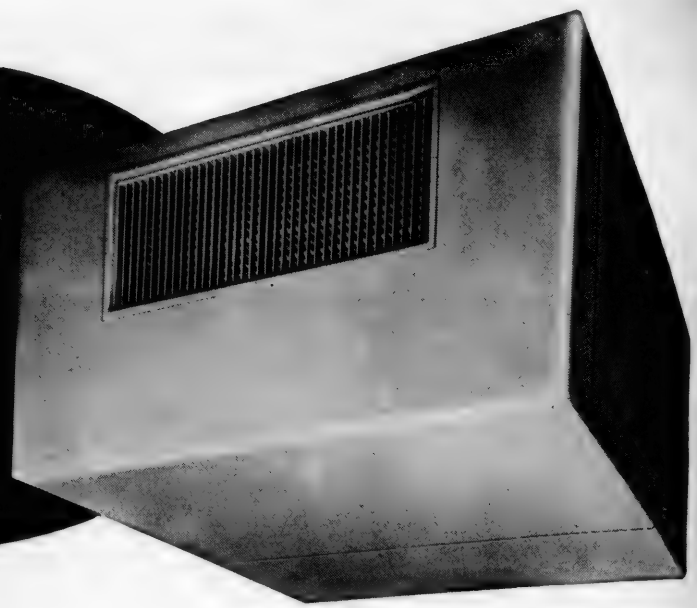
For a detailed illustrated description of how you can benefit from the cost-saving features of the B&W Type FM Boiler, write for Bulletin G-76A. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd St., New York 17, N. Y.

BABCOCK & WILCOX

BOILER DIVISION

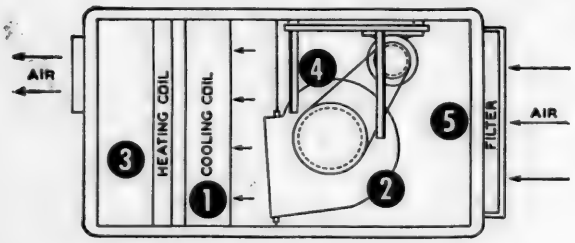
G-611

NEW FEATURES of PROVEN MERIT



KRAMER

AIR CONDITIONING UNITS



1 MUGGY-AIR-CONTROL

It "squeezes" extra moisture from the air on muggy days without reheating, dampers or excessive cooling. No short cycling and uncomfortable conditions.

2 "BLOW-THROUGH" DESIGN

Fan-motor assembly always exposed to normal room temperatures. A unique design with many advantages, resulting in —

No motor overload and no loss of bearing lubricant from hot air of the heating coils.

No corrosion of fan-scroll assembly from moisture carry-over of the cooling coils.

3 ANTI-SWEAT CONSTRUCTION

Only a small portion of the casing is exposed to cooled air; that section is heavily insulated.

Access doors and grille have scientific anti-sweat designs.

4 QUIET OPERATION

The fans and motor form an integrated assembly independently rubber-mounted to the casing. All moving parts are completely isolated by rubber.

5 FOR FINISHED INTERIORS

Graceful lines with no unsightly belts, motor and guards exposed to view. Finished in hammer gray enamel.

MANY OTHER OUTSTANDING FEATURES.

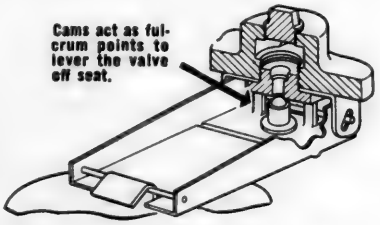
WRITE FOR BULLETIN AC-238

KRAMER TRENTON CO. • Trenton 5, N.J.

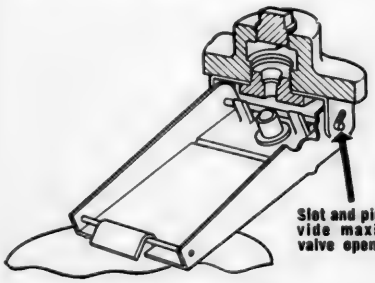
See how this NEW trap handles greater volume in less time

Yet it's small—gives you maximum capacity per dollar cost

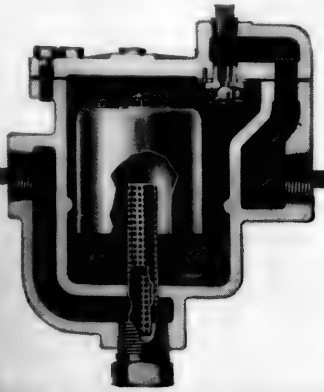
NEW SARCO
INVERTED BUCKET TRAP
with CAMLIFT valve mechanism

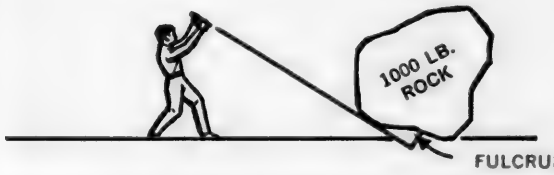


As bucket sinks CAMLIFT mechanism provides the powerful crowbar action needed to open large valve against steam pressure.

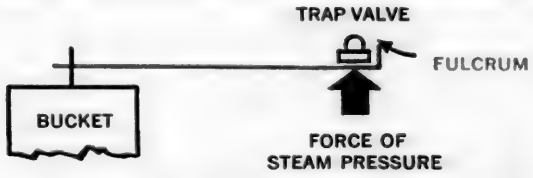


When steam pressure is overcome CAMLIFT mechanism drops to limit of slot, allowing rapid and free discharge of condensate.





MAN WITH CROWBAR MOVES 5 TIMES HIS WEIGHT



TRAP WITH *CAMLIFT* MECHANISM OPENS LARGE VALVE AGAINST MAXIMUM OPERATING PRESSURES

SARCO takes the principle of the fulcrum, incorporates it in its newly designed trap and gives you greater discharge with *no increase in trap size*. That means you get more for your steam trap dollar.

The Sarco *Camlift* valve mechanism makes this possible. It provides the powerful force needed to open the unusually large valve without a corresponding increase in trap size.

If you need a trap that's also rugged and simple in design, then we suggest you try this new Sarco Inverted Bucket Trap – in fact, we'd like to send you one for a free trial. We're confident you'll be convinced. Just clip the coupon and mail it in.

SARCO COMPANY, INC., Empire State Bldg., New York 1, N.Y.
Sarco Canada Ltd., Toronto 8, Ont.
Represented in Principal Cities

MAIL THIS COUPON TODAY FOR FREE TRIAL

Put this new inverted bucket trap to the test—see for yourself how to get more for your trap dollar.

Sarco Company, Inc., Empire State Bldg., New York 1, N.Y.

Gentlemen: Please send me a ½" Sarco Type B Bucket Trap for free trial. Maximum working pressure_____ psi; capacity_____ lbs/hr condensate.

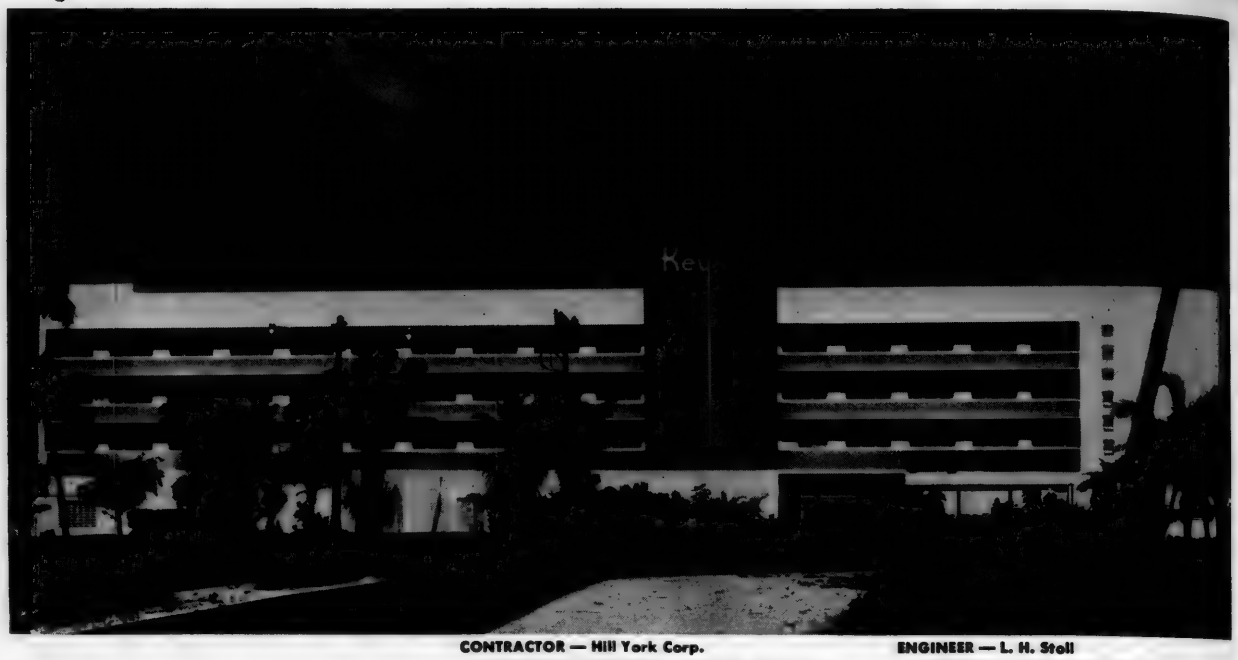
NAME_____ TITLE_____

FIRM_____

ADDRESS_____

CITY_____ STATE_____

STEAM TRAPS • TEMPERATURE CONTROLS • STRAINERS • HEATING SPECIALTIES



CONTRACTOR — Hill York Corp.
CONSULTING ENGINEER — Sasnett & Bennett
ENGINEER — L. H. Stoll
ARCHITECT — Herbert A. Mathes

Acme becomes a permanent tenant at MIAMI'S KEY BISCAYNE HOTEL

The beautiful, new Key Biscayne Hotel in Miami, Florida is another of the recently constructed hotels that is following the trend toward 100% air conditioning. Hotel owners and managers realize that the public demands more than the comforts of home when it goes on a trip or vacation. It gets them in the cool, comfortable environment offered by the Acme air conditioning system at the Key Biscayne.

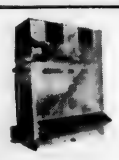
The Acme equipment used in this 120 ton system includes an Acme Dry-Ex Water Chiller furnishing 570 GPM of 46° water, an Acme STF Freon Condenser, an Acme Liquid Receiver, and an Acme Oil Separator. Engineered for maximum efficiency, the Acme system has fulfilled all the expectations of management and customer alike.

Sturdy, efficient, economical, and dependable Acme products have been used in the air conditioning and refrigeration industry for 35 years. Acme design experience stands behind all of their products. These reasons make it wise to specify Acme on any air conditioning installation.

ACME INDUSTRIES, INC.

Mfgs. of a complete line of Air Conditioning and Refrigeration Equipment

JACKSON, MICHIGAN



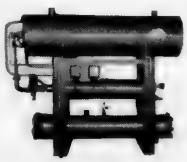
Evaporative Condensers
Cooling Towers
Floor-type Unit Coolers

Direct Expansion (Dry-Ex) and Flooded Liquid Chillers

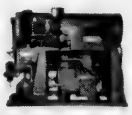
Heat Exchangers, Oil Separators

Shell and Tube, Shell and Coil Condensers

Receivers, Pipe Coils

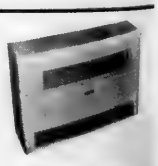


Packaged Liquid Chillers to 225 tons



Flow-Temp Heat Pumps

Flow-Cold Liquid Chillers



Remote Room Conditioner

Continuously serving the air conditioning and refrigeration industry since 1919

SAVE PURCHASING MANHOURS...

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WHEN you put your TUBE TURNS' Distributor on your buying team, you can consolidate many orders into one . . . saving you valuable time. Your TUBE TURNS' Distributor assumes the responsibility of dealing with many manufacturers' salesmen and expediting and following through your orders.

TUBE TURNS' Distributors and TUBE TURNS are a service-minded team. Call your nearby TUBE TURNS' Distributor to save your purchasing time, to simplify your bookkeeping, and to obtain leading brands . . . brands that have got to be good.

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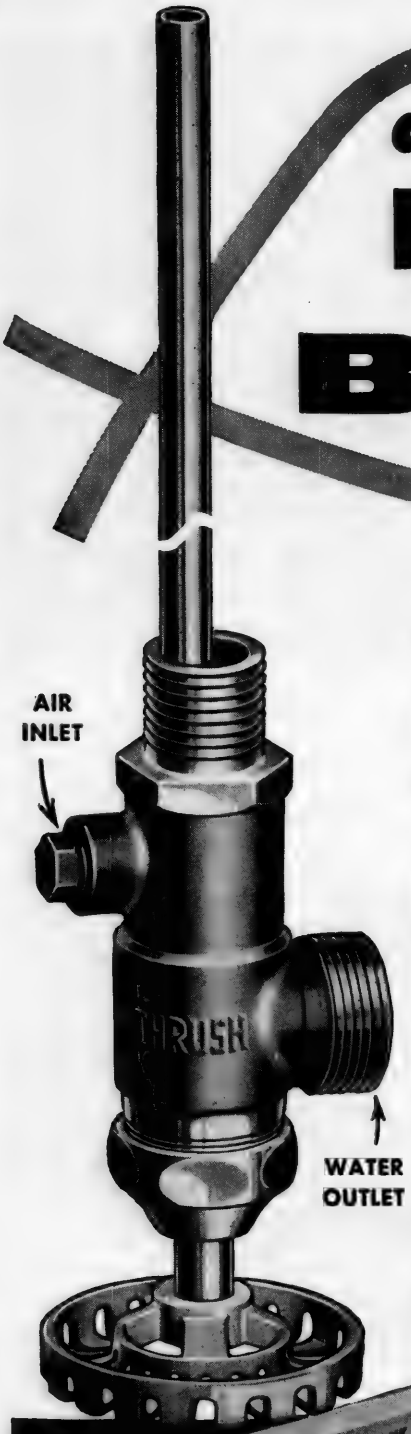


You can sell a THRUSH Tank Drain for every expansion tank on any existing installation

YOU CAN SAVE your customer money, save yourself time and bother . . . and make a profit, too, by selling and installing Thrush Tank Drain. This simple, inexpensive Tank Drain combines an air tube with a drain and fits any drain tapping. Two lengths of tube are available.

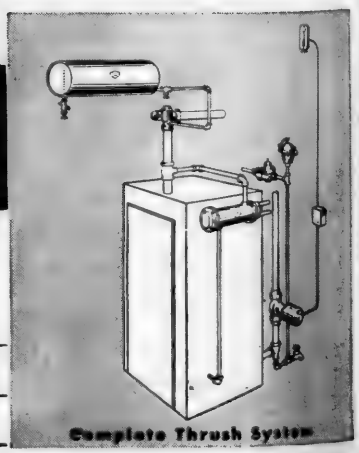
REDUCES DRAINING TIME!

Draining waterlogged expansion tanks is simple, quick and positive with a Thrush Tank Drain. While all genuine Thrush Pressure Tanks now have Thrush Vacuum Breaker, there are many old installations where the tank has only one drain tapping. Sell them a Thrush Tank Drain. Just screw it into the drain tapping. Then remove the air inlet plug to break the vacuum and open the water outlet. The tank will drain quickly and completely. It's a profit item you can sell every day. For more information see your wholesaler or use the coupon below.

H. A. THRUSH & COMPANY

NEATLY BOXED

MAIL NOW!


Complete Thrush System

H. A. THRUSH & COMPANY, Dept. D-3, PERU, INDIANA

Please send, without obligation, more information on the Thrush Tank Drain.

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ADDRESS _____

CITY _____ STATE _____

Caps are part of the story

The announcement of the WeldELL line, back in 1931, created a considerable sensation in the piping field. Pipe welding was then just beginning to emerge from the crude, cut-fit-patch stage and the only welding fittings then in use were simply elbows.

But here was a *full line* of welding fittings—not only the long and short radius ells, but also full branch and reducing tees, concentric and eccentric reducers, stub ends, welding neck flanges . . . even *caps!*

You know what happened: The WeldELL line had taken pipe welding out of darkness into light . . . had provided the impetus and set the pattern of modern pipe welding practice.

Yes, the WeldELL line was the first complete line—the first engineered line . . . and the fittings that showed the way are still showing the way. For up-to-the-minute facts about the WeldELL line see your Taylor Forge Distributor.

TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS

General Offices and Works: P. O. Box 485, Chicago 90, Illinois

Offices in all principal cities • Plants at: Carnegie, Pa.; Fontana, Calif.; Gary, Ind.; Hamilton, Ont., Can.

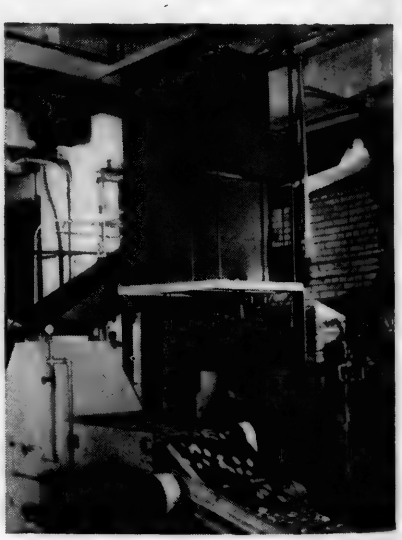
A TASTY BUT DISTRESSING PROBLEM

Felber Biscuit Company in the process of spraying hot cocoanut oil on their delicious Town House crackers, acquired an unwelcome oil mist problem. A fan exhaust system—installed to clear the air—wasted gallons of costly cocoanut oil and created a dangerous fire threat.

How to flavor these famous crackers without oil-painting the entire building? Felber Biscuit did it with an Oil Mist PRECIPITRON!

Excess oil mist is now drawn into a Westinghouse PRECIPITRON and out of the air completely. Result: mist, mess and fire hazard have disappeared. Valuable cocoanut oil is now salvaged for re-use. Employee working conditions are greatly improved.

Perhaps Westinghouse PRECIPITRON can draw savings out of the air for *you*. There is a PRECIPITRON for every application for removing contaminants from the air. For an answer to *your* specific air cleaning problem . . . call your nearest Westinghouse-Sturtevant office today. Or write to Sturtevant Division, Westinghouse Electric Corporation, Hyde Park, Boston 36, Mass.



Westinghouse PRECIPITRON suspended directly over the hot cocoanut oil spray collects excess oil mist from the spraying operation. Clean air is returned to the room; valuable oil is reclaimed.

WESTINGHOUSE AIR HANDLING

YOU CAN BE SURE... IF IT'S **Westinghouse**

J-80332

• Some of the 189 YARWAY Gun-Pakt expansion joints installed at large oil refinery in Texas.

No fatigue with 189 YARWAY GUN-PAKT EXPANSION JOINTS at this large Texas refinery

THEY just work and work for years and never get tired. Yarway Gun-Pakt slip-type joints simply will not fail through fatigue. They will operate smoothly, as frequently as required, over long, full traverse up to 12" single type or 24" double type or short, partial traverse, day in and day out—with never any danger of metal fatigue or failure.

This is just one of the many big advantages found in Yarway Gun-Pakt expansion joints. Other outstanding Gun-Pakt features are:

1. Can be serviced under *full* steam pressure day and night, thus avoiding costly and inconvenient shutdowns.
2. Fixed Gun-Pakt gland serves as "built in" external guide and permits less costly and rigid pipe guidance than required by many other types of joints.
3. Lower pressure load on end anchors because excessive strains are eliminated.

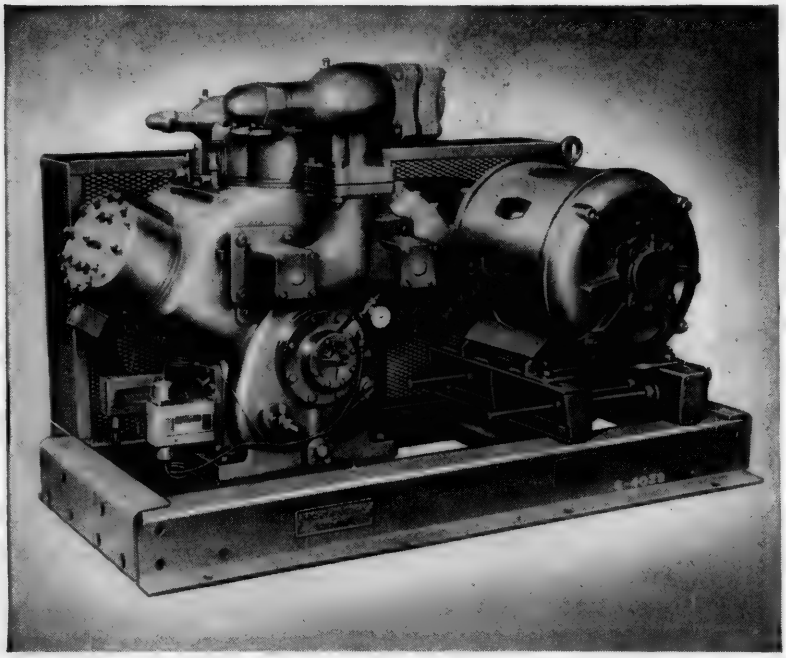
Used for many years with success in well-known refineries, industrial plants, utilities and institutions. When replacing present joints or planning new steam lines, it will pay you to look into the advantages of the Yarway Gun-Pakt expansion joint. Write for Yarway Bulletin EJ-1913.

YARNALL-WARING COMPANY
104 Mermaid Avenue, Phila. 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

YARWAY

gun-pakt expansion joints

The whole industry's talking about Worthington's new Freon compressor



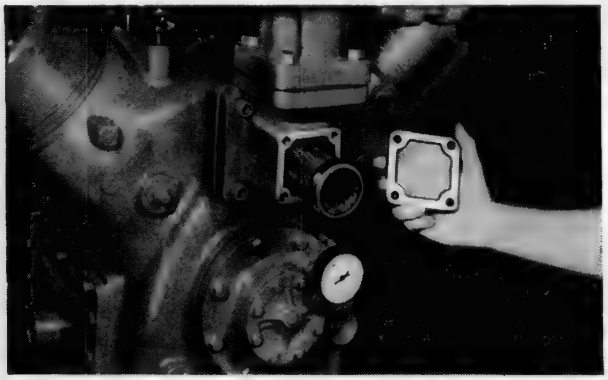
TRIM, STURDY CONSTRUCTION marks this 4JF6 compressor unit — 50-60 hp, six cylinder W-type compressor. The complete compact unit consists of fabricated steel base, compressor with valves, gauges and safety controls, drive and safety guard. Designed to operate in conjunction with Worthington evaporative condensers in localities where city water is scarce or high in cost. Also available with shell and tube condenser. Complete range from 3-150 hp.

"The high capacity unit we've been waiting for!"

"Greater operating efficiency!"

"There's nothing else like it!"

And every comment you hear is true! The refrigeration compressor is the most vital element of any air conditioning or refrigeration system. That's why Worthington spent years in developing the new "J" Freon compressor. That's why Worthington invested over a million dollars in compressor research. *And that's why you can't find its match in any other unit.* Only a few features of the new "J" Freon compressor are highlighted here — get the full story by contacting your nearest Worthington district office or write to Worthington Corporation, Air Conditioning and Refrigeration Division, Section A.4.33, Harrison, New Jersey.

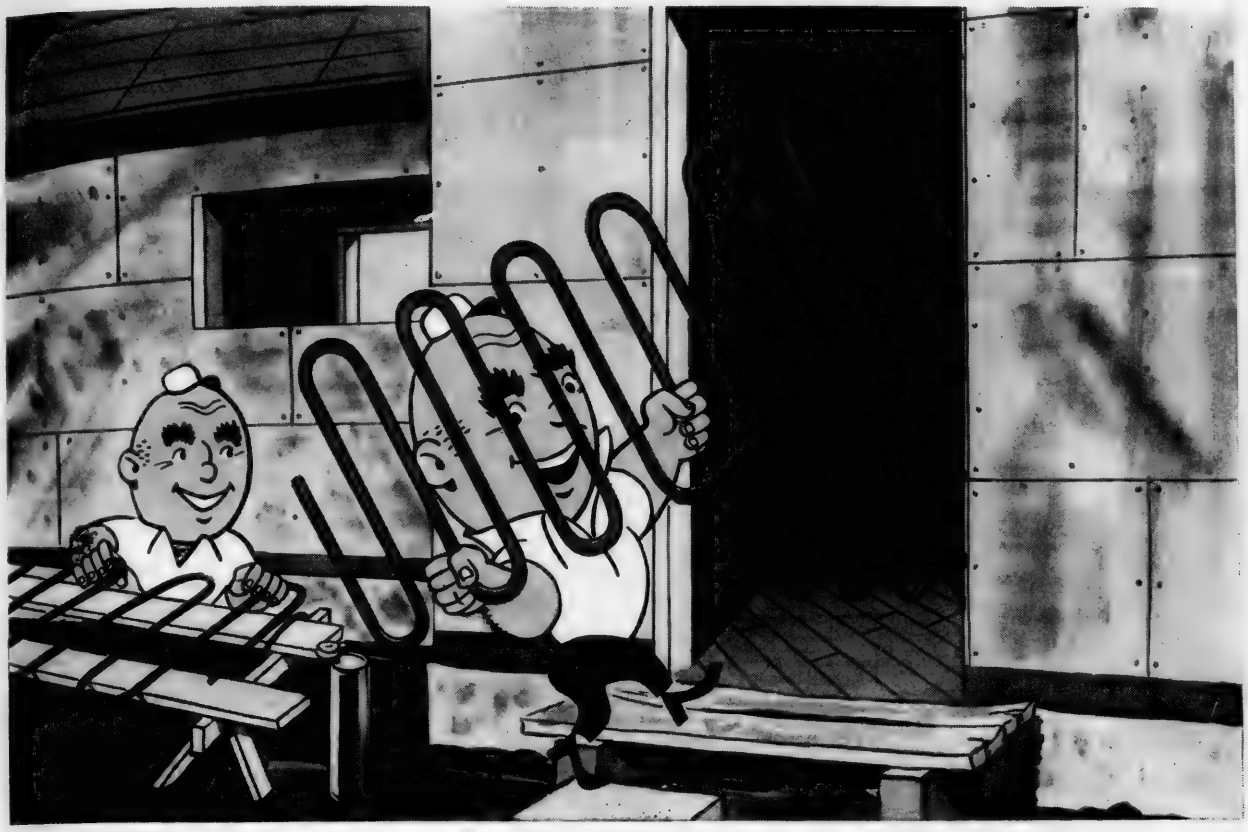


EASY REMOVAL of suction gas strainer for cleaning is made possible by new suction manifold design. No pipes, valves or other parts need to be dismantled in order to get at the strainer. And Worthington's new electric unloaders automatically balance power consumption with load requirements.

LORD & TAYLOR'S new West Hartford, Conn., store depends on Worthington to provide comfortable air conditioning for its customers. Two 150 hp "J" compressors and two evaporative condensers make up the highly efficient Worthington air conditioning team at this modern store. A.4.33

WORTHINGTON

CLIMATE ENGINEERS TO INDUSTRY, BUSINESS AND THE HOME



Offer ceiling radiant heating at lower cost

You save material costs and fabrication time with Bundyweld Tubing, performance-proved in thousands of ceiling radiant heating systems throughout the country.

Consider these advantages: Bundyweld is extra-strong, yet ductile; bends easily to short radii on a simple fixture in the shop or at the job site. It comes in standard, 20′ lengths with one end expanded, when specified, for simpler, sounder joining.

Bundyweld is tough enough to withstand the usual rough handling, too. Although lightweight, it's rigid enough so that two men can easily position a group of joined coils. The smooth coils keep their shape; lie flat against the ceiling for easy plastering, with no waste of time or material.

In your completed system, Bundyweld transmits heat efficiently; conducts water with a minimum of friction. Just check below for the advantages that only Bundyweld can give you. Then, write us today for more information.

Radiant Heating Division
Bundy Tubing Company • Detroit 14, Michigan

Bundyweld® Tubing

DOUBLE-WALLED FROM A SINGLE STRIP

WHY BUNDYWELD IS BETTER TUBING

Bundyweld starts as a single strip of steel which is copper-coated. Then, it's . . .

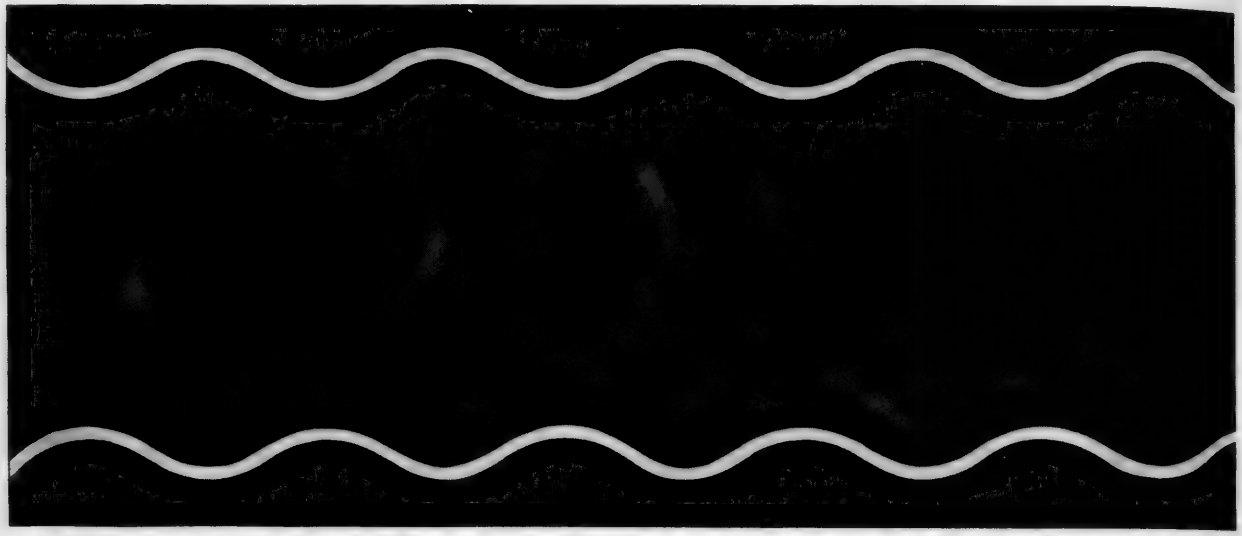
continuously rolled twice around laterally into a tube of uniform thickness, and

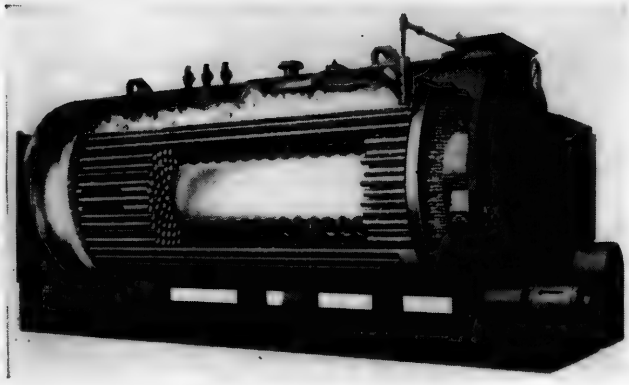
passed through a furnace. Bonding metal fuses with basic metal. Result . . .

Bundyweld . . . double-walled and brazed through 360° of wall contact.

NOTE the exclusive Bundy-developed beveled edges, which afford a smoother joint, absence of bead, and less chance for any leakage.

Introducing *Continental's* Spinning Gas Technique*





*In the Continental, air is forced through static turbine-like vanes which cause air to enter the furnace with a spinning motion. This technique achieves thorough mixing of air and atomized fuel, better combustion, a slower passage of hot gases through the furnace, and a greater amount of heat transfer. On the second pass, gases are spun again by means of a stationary impeller in each 3" return tube. So much heat is transferred by the two-pass design and spinning gas technique that an independent engineering firm found operating efficiency of the unit under test to be 84.23% . . . with steam quality at 99.43%.

Through use of the spinning gas technique the Continental Automatic Boiler achieves full combustion and over 80% efficiency by means of a two-pass design . . . Due to this technique and design the Continental costs little to maintain, gives long service life, and results in fuel costs equal to, if not lower than most other type packaged units.

Owners report that they can open a Continental for cleaning or inspection in less than a half hour—due to the hinged doors on both ends. Another owner reports fuel savings of 25%—the result of Continental's spinning gas technique and improved design.

For full details on the many exclusive features and advantages of the Continental Automatic Boiler—units from 20 to 500 hp; 15 to 200 lbs. W.P.—write for new Bulletin BE3.

CONTINENTAL BOILER DIVISION
BOILER ENGINEERING & SUPPLY COMPANY, INC.
Phoenixville, Pennsylvania

40 YEARS OF BOILER MANUFACTURING EXPERIENCE

CONTINENTAL is sold, installed and serviced by competent distributors throughout the U.S.

"MADE TO ORDER"

THE IDEAL UNIT FO

. . . air conditioning

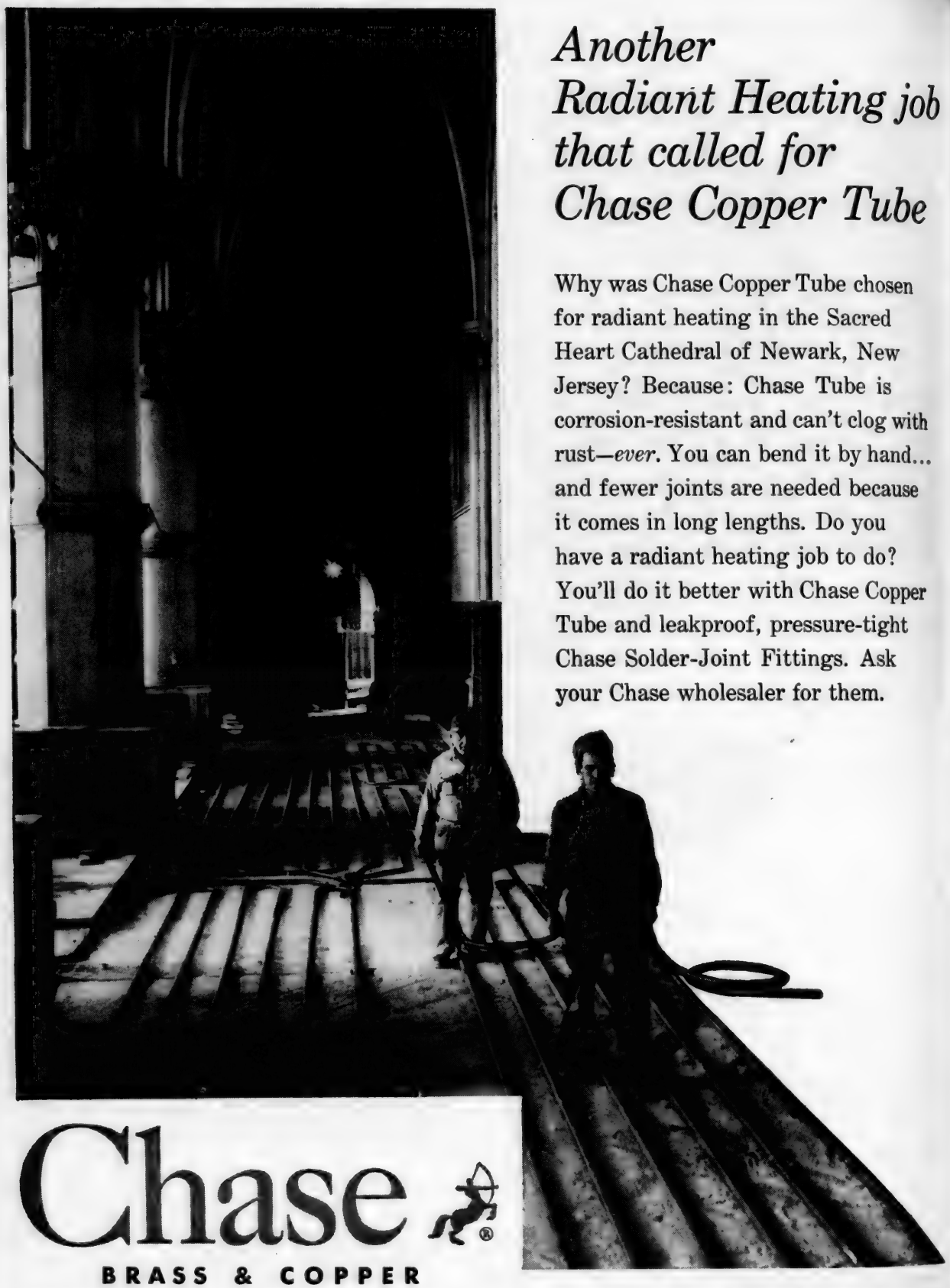
Compact design—efficient trouble-free performance—The Skidmore "CV" Pump has long been a favorite in the heating pump field. NOW, this pump is winning new popularity, engineers and contractors are specifying the Skidmore "CV" Pump for industrial and commercial air conditioning installations. Requiring a maximum space of 15" x 15" x 22" this Skidmore Pump is easy to install and economical to operate.

Pump is fitted throughout with enclosed centrifugal impeller. Shaft is stainless steel. Self lubricating bronze bearing directly above impeller. Each pump is completely assembled and tested at factory. Call or write today for immediate shipment, or contact your Skidmore representative for full details.

Skidmore Pumps have set a standard of performance and dependability through continual research and development since 1921.

SKIDMORE PUMPS

SKIDMORE CORPORATION • ST. JOSEPH, MICHIGAN



Another Radiant Heating job that called for Chase Copper Tube

Why was Chase Copper Tube chosen for radiant heating in the Sacred Heart Cathedral of Newark, New Jersey? Because: Chase Tube is corrosion-resistant and can't clog with rust—*ever*. You can bend it by hand... and fewer joints are needed because it comes in long lengths. Do you have a radiant heating job to do? You'll do it better with Chase Copper Tube and leakproof, pressure-tight Chase Solder-Joint Fittings. Ask your Chase wholesaler for them.

Chase ®

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JOHNSON CONTROL

Automatically provides

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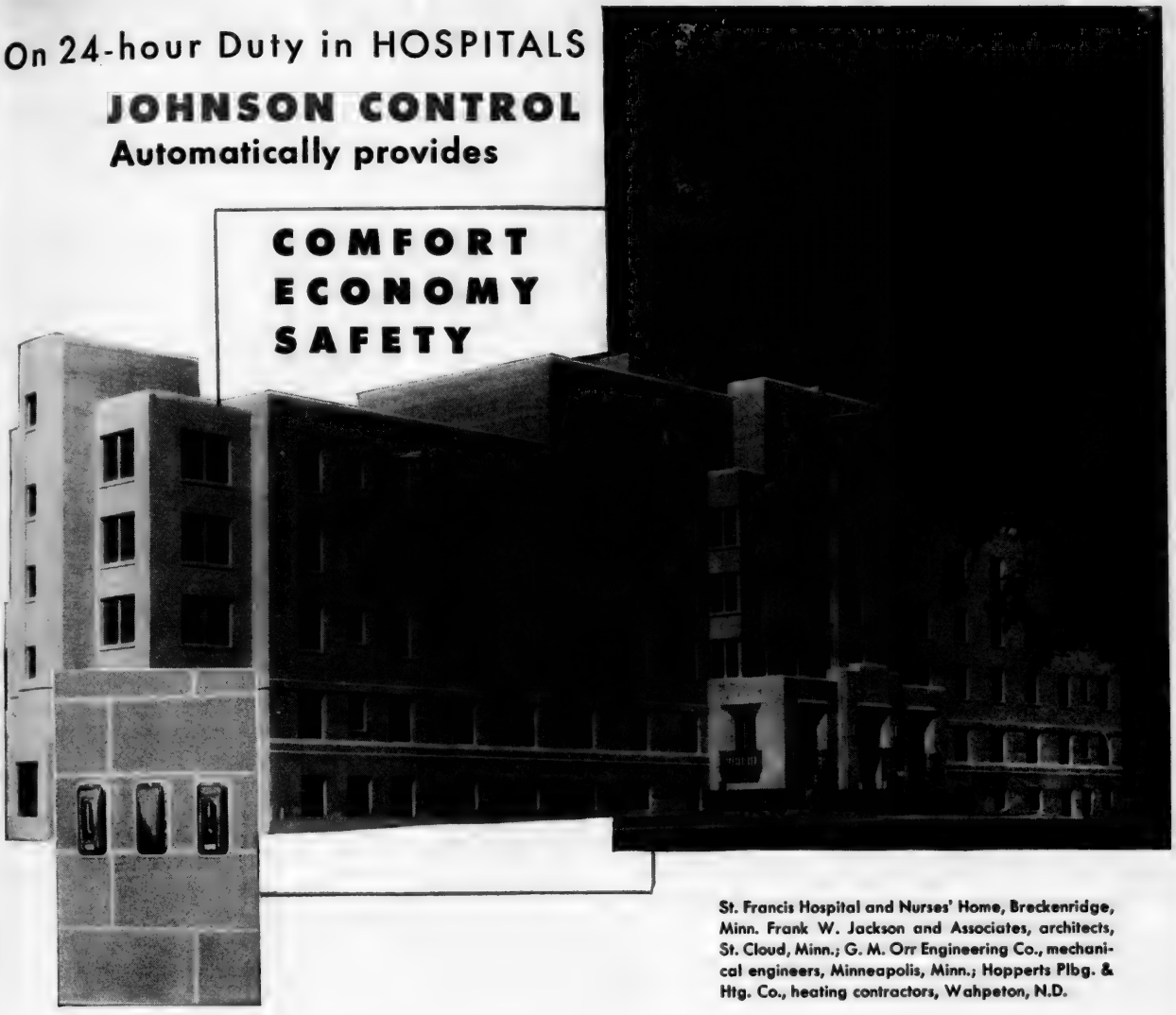
ECONOMY
SAFETY

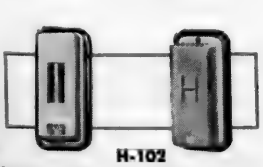


St. Francis Hospital and Nurses' Home, Breckenridge, Minn. Frank W. Jackson and Associates, architects, St. Cloud, Minn.; G. M. Orr Engineering Co., mechanical engineers, Minneapolis, Minn.; Hopperts Plbg. & Htg. Co., heating contractors, Wahpeton, N.D.

The comfort and health of patients, at St. Francis Hospital in Breckenridge, Minn., are constantly guarded by Johnson Automatic Temperature and Humidity Control. Here, the exact temperatures and humidities required in operating rooms, obstetrical rooms and other vital areas are maintained by Johnson Thermostats and Humidostats operating Johnson Valves and Dampers. Like all Johnson Control Systems, this installation was designed *and installed* by Johnson to meet the specific requirements of the control problems encountered in this particular building.

Because it is *pneumatically* operated, Johnson Control meets the most exacting hospital safety requirements. Completely safe, even in the presence of explosive anesthetic gases. And, Johnson Humidity Control guards against the dangers of static electricity.

Whether *your* problem involves the control of temperatures and humidities in a single operating room or an entire hospital, call a Johnson engineer from a nearby branch office. There is no obligation, of course. JOHNSON SERVICE COMPANY, Milwaukee 2, Wisconsin. Direct Branch Offices in Principal Cities.



T-403 Room Thermostat

H-102 Room Humidostat

JOHNSON *Automatic Temperature and Air Conditioning* **CONTROL**

MANUFACTURE • APPLICATION • INSTALLATION • SINCE 1885

HOW TO: HEAT LARGE OPEN AREAS AT LOWEST COST

DELTA DIRECT-FIRED OIL UNIT HEATERS can be installed for at least 60% less than with costly steam systems. The spectacular new DELTA heater, fired with a gun-type burner, eliminates large, heavy, boilers, does away with numerous steam traps, eliminates a multitude of pipes and fittings. It does a powerful heating job (output -- 220,000 BTU/hr) without a large, high-draft chimney. It requires no valves, no insulation no expensive condensate pumps, no strainers. With the DELTA Unit Heater you can reduce your heating maintenance staff. No wasted heat, no overheating. A space-saver, the compact, portable 50" high heater suspends overhead or mounts on a dolly. Individual firing units eliminate the danger of costly breakdown of the complete heating system. This is the NEW WAY...the BEST WAY...the NEW MODERN WAY... to heat troublesome wide open spaces effectively, efficiently and above all...economically!

Cutaway View

WHY AN *OIL* FIRED UNIT HEATER?

STEAM unit heaters, which have been used for over a decade, require multitudinous pipes and fittings, boilers steam traps and controls. Boilers large enough for severe cold waste fuel in warmer weather.

The direct-fired GAS unit heater, self-contained and cheaper to install, was better; but its use is limited by the expense of manufactured gas in many areas or by the need for bottled gas during low pressure periods in many natural gas areas.

The oil-fired SUSPENDED-HORIZONTAL furnace at first seemed an improvement. While good for partitioned areas, it was large, required larger chimneys to burn fuel properly and costly ducts to develop sufficient velocity to bathe the entire floor area.

NOW DELTA FEATURES THE DIRECT-FIRED OIL UNIT HEATER...THE PERFECT SOLUTION TO THE NEEDS OF INDUSTRIAL HEATING

SEE OUR ENTIRE LINE AT THE NATIONAL INDOOR COMFORT EXPOSITION — BOOTHS 151-153

To efficiently heat offices and closed partitioned areas, see the DELTA line of SUSPENDED-HORIZONTAL FURNACES in various sizes for small or large heating jobs.

SEND FOR COMPLETE LITERATURE ON THE DELTA LINE OF HEATING PRODUCTS

DELTA HEATING CORPORATION • TRENTON 8, N. J.

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Here's what you've been looking for!

POWER ROOF VENTILATOR

CARNES

(Above Style Available in Sizes up to 36")

And . . . you'll find everything you want with Carnes Power Roof Ventilators. These heavy duty ventilators for all types of commercial and industrial installations are available in a large range of sizes — with duct sizes from 4" to 36" and capacities from 100 CFM to 17,600 CFM. Plus . . . quiet operation; easy installation; exhaust without back draft; extremely low in silhouette for attractive appearance; and longer lasting, economical service. Write today for complete information on the Carnes line. Get the best . . . Get Carnes!

. . . this all-aluminum power roof ventilator with the famous CARNES "know how"

★ **LOW SILHOUETTE**
Carnes roof ventilators will not extend above the normal roof parapet — making a neat, attractive installation.

★ **AVAILABLE NOW**
Shipment of all sizes and all types of ventilators can be made without delay.

★ **COMPETITIVELY LOW-PRICED**
You'll be amazed at the price of Carnes Roof Ventilators. Prices are in line with those of ordinary ventilators.

★ **NON-SPARKING ALUMINUM FAN WHEELS**
This important safety feature available as standard equipment at no extra cost. Available in both backwardly inclined centrifugal fan wheels and axial flow fans.

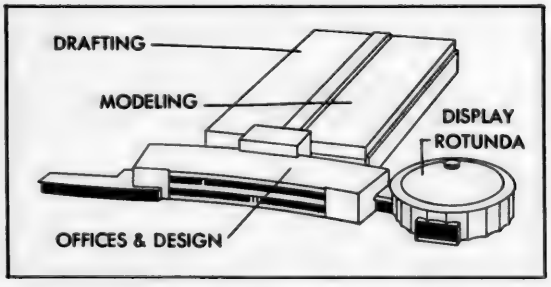
★ **ALL-ALUMINUM CONSTRUCTION**
For years and years of dependable, non-rusting service, and highest quality appearance.

CARNES The Most Talked About Name in Air Distribution

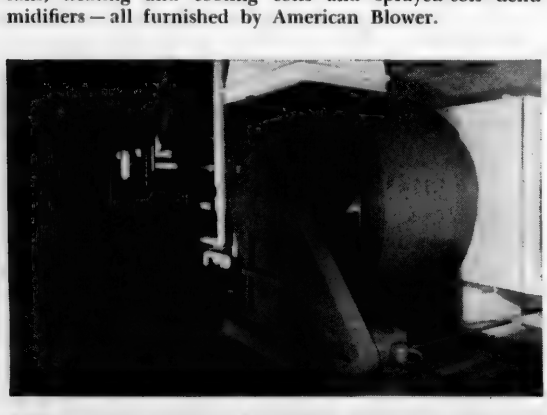
W. R. CARNES CO., VERONA, WISCONSIN

Advanced Styling Section of Ford Motor Company's new $11.5 million Styling Building, Dearborn, Michigan.

Ford "dream shop" has built-in climate!



The design-office wing and display rotunda are served by a central system. It includes: 7 supply fans; 34 exhaust fans; heating and cooling coils and sprayed-coil dehumidifiers — all furnished by American Blower.



Air for drafting rooms and modeling studios is conditioned by 24 specially built, automatically controlled American Blower Air-Conditioning Units. Each unit contains heating and cooling coils and capillary air washers.

This "dream shop" at the Ford Engineering Staff's Advanced Styling Section is just one of many styling areas which depend on clean, conditioned air.

For example, in 12 roomy studios clay-modeling teams work under lights which produce shadowless illumination — and intense heat! To absorb this heat and provide the proper climate for working with clay models, specially designed air-conditioning systems were installed for each studio and drafting room. American Blower Air Handling and Air-Conditioning Equipment was used for this unusual assignment.

The expert know-how of American Blower engineers is on tap for industry at all times. If you have an air-handling or air-conditioning problem, phone your nearest American Blower or Canadian Sirocco Branch Office.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
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A GOOD WELDING MACHINE IS IMPORTANT - BUT IMPORTANT JOBS DEPEND ON

GOOD PIPE

QUALITY V YOUNGSTOWN SERVICE

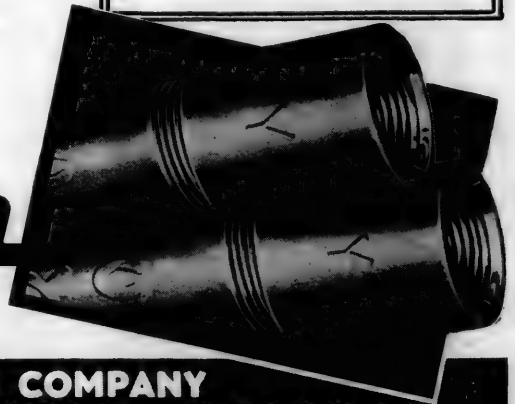
7 POINTS OF UNIFORM GOODNESS IN

YOUNGSTOWN STEEL PIPE

- uniform ductility
- uniform lengths
- uniform threading
- uniform weldability
- uniform wall thickness and size
- uniform strength and toughness
- uniform roundness and straightness

NO matter how intricate the weld, you do it readily with Youngstown pipe.

That's because Youngstown pipe is designed and made for easy welding—truly round, uniform in wall thickness, uniformly sized, and chemically and metallurgically right. The name "Youngstown" rolled into a length of pipe means it is GOOD PIPE.



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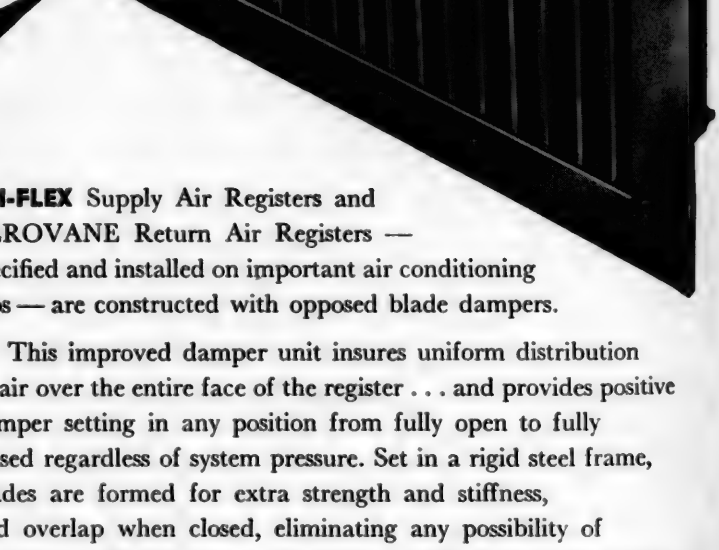
TRI-FLEX and AEROVANE REGISTERS equipped with

Opposed Blade Dampers



Showing TRI-FLEX T-647 Double Deflection Register with Opposed Blade Damper

KEY OPERATOR FOR OPPOSED BLADE DAMPER

Blades are regulated by key operator which may be removed or tapped permanently into place.

Damper fully open.

Damper partially open.

Damper fully closed.

TRI-FLEX Supply Air Registers and AEROVANE Return Air Registers — specified and installed on important air conditioning jobs — are constructed with opposed blade dampers.

This improved damper unit insures uniform distribution of air over the entire face of the register . . . and provides positive damper setting in any position from fully open to fully closed regardless of system pressure. Set in a rigid steel frame, blades are formed for extra strength and stiffness, and overlap when closed, eliminating any possibility of air leakage. Blades are regulated through the face of the register by means of a key operator which may be removed or tapped permanently into place.

For complete information and size selection data for TRI-FLEX and AEROVANE Registers and Grilles, write for a copy of Catalog No. 200.

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GUIDE

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Revised 1954 Edition—APRIL DELIVERY

A Basic Work Book

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Heating, Ventilating, Air Conditioning engineers use it to solve difficult problems—keep it handy for ready reference. Engineers—Contractors—Dealers—Students—use this book constantly for answers to heating, ventilating, air conditioning problems. All chapters of the 1954 Edition have been carefully revised to include latest developments in the industry. No other source contains such practical, useful data as does this husky 1616 page GUIDE. Here you will find 52 chapters, 52 good reasons why you owe it to yourself to own a copy of THE GUIDE 1954.

THE GUIDE IS UNIQUE

There is no other book like it. It is an indispensable tool—a ready reference volume when estimating and planning construction work. It is a "must" for engineers who need technical data for designing and calculating, or for writing specifications. Architects need it for coordinating heating, ventilating and air conditioning design with their plans and specifications. Superintendents, factory engineers, operators, and managers of large structures, office buildings, schools, auditoriums, and institutions, all need THE GUIDE.

TYPICAL SECTIONS

AIR CONDITIONING SYSTEMS: Equipment arrangement, and operation for year 'round air conditioning explained simply. Cost of owning and operating outlined. **AIR CONTAMINANTS:** Nature and control of contaminants in air discussed and limits indicated. **AIR DISTRIBUTION:** Standards and methods for proper air distribution given. Formulas and charts included to aid in selection of outlets. **AIR DUCT DESIGN:** Includes ASHVE Air Friction Charts, together with basic formulas and tables for rectangular equivalents of round ducts and friction loss in elbows. Practical design for duct system illustrated. **CHIMNEYS:** Theory and actual operation of large and small chimneys considered. Formulas and charts for selecting residential chimney sizes included. **CODES:** Latest editions and sources of 145 codes and standards compiled for ready reference. **COOLING LOAD:** Weather design data for 316 localities listed. Solar heat gain tables included for glass, glass block, and figured rolled glass from ASHVE research. Simplified method shown for computing heat gain through walls and roofs. **DRYING SYSTEMS:** Theory and methods of drying outlined. Typical drying equipment illustrated. **FLUID FLOW:** Basic theory of fluid flow through pipes, nozzles, and orfices presented clearly and concisely. **FUELS, COMBUSTION, AND EQUIPMENT:** Gives properties of present-day fuels and their combustion data. Adjustment and operation of fuel-burning equipment explained. **HEAT LOSS CALCULATIONS:** Includes basic formulas and extensive tables for determining building heat loss for typical construction. Weather design conditions given for U. S. and Canadian cities. **HEAT TRANSFER:** Basic formulas applying to heat transfer by conduction, convection, and radiation are developed. Unit conductances for thermal convection for various surfaces are tabulated. Net radiation solutions for various relative positions of surfaces are given. **HEATING SYSTEMS:** Various types of steam, hot water, panel, warm air, and all-year comfort systems described. Data for determination of pipe and duct sizes. **INDUSTRIAL AIR CONDITIONING:** Design conditions given for manufacturing large number of products. **INDUSTRIAL EXHAUST SYSTEMS:** Data given for design of hoods, ducts and complete systems. **INSTRUMENTS:** Outlines methods of measurement and instruments used in heating, ventilating and air conditioning. **PANEL HEATING:** A simple method for design of panel heating systems, including snow melting. **PHYSIOLOGICAL REACTIONS:** Basic data and standards for comfort, explains reaction of human beings to atmospheric environment outside comfort range. Includes ASHVE Comfort Chart. Shows value of air conditioning in prevention and treatment of disease. **REFRIGERATION:** Simple presentation of different refrigeration cycles, types and functions of equipment, and controls. Outlines factors affecting use of the heat pump. **RESIDENTIAL SUMMER AIR CONDITIONING:** Equipment arrangement, installation, operation and maintenance. Cost of owning and operating detailed. Recommendations as to size and type of system for use under varied climatic conditions. **THERMODYNAMICS:** Simple discussion of thermodynamics in air conditioning, with illustrative problems showing use of ASHVE Psychrometric Chart and tables of properties of air from —160 F to +200 F. **WARM AIR SYSTEMS:** Design of gravity and forced circulation systems simplified by use of tables. Small duct, perimeter and ceiling panel systems described. **WATER SERVICES:** Shows how to determine service water demand, pipe sizes for cold and hot water systems, for cooling towers and for refrigeration. Gives data for selection of heater and storage tank capacity.

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62 Worth St., New York 13, N. Y.

Enclosed is $10.00 for standard edition of HEATING, VENTILATING, AIR CONDITIONING GUIDE 1954; please send me a copy. It is understood that I may return it within 10 days, if it is not satisfactory, and you will refund my money.

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HV

BUSINESS AS USUAL

with snow melting!

Snow Melting keeps business "on the go"

Many progressive businesses *make their own weather* as far as controlling the all-winter accessibility of their properties is concerned. For thousands of snow and ice removal systems now assure "business as usual," to the foresighted, by preventing interruptions in the flow of commerce once caused by sudden and heavy snows and surface icing conditions.

Yes, steel pipe snow and ice melting systems do eliminate winter weather transportation delays on driveways and sidewalks, ramps, shipping docks and approaches, parking areas, garage and service aprons, and even private spurs and tracks. So in every business where snow and ice are unfavorable factors . . . from service stations and supermarkets to warehouses and factories . . . snow melting keeps business "on the go."

Steel Pipe of course, is the preferred heat transmission medium for commercial, industrial and domestic snow melting systems. The combination of advantages that has made it the stand-by of industry for heating, plumbing, fire sprinkler systems, power, steam and air transmission, for more than 60 years, also makes it ideal for the panels, coils and runs of snow melting systems.

As ever, for snow melting as for other uses, *steel pipe is first choice* . . . the most widely used pipe in the world.

Steel Pipe is First Choice

Send for new, free 32 page color booklet "Steel Pipe Snow Melting and Ice Removal Systems."

COMMITTEE ON STEEL PIPE RESEARCH

AMERICAN IRON AND STEEL INSTITUTE

350 Fifth Avenue, New York 1, N.Y.

1 of the many reasons why you will find it pays to sell Chrysler Airtemp

"Packaged" air conditioning by CHRYSLER AIRTEMP

costs less to install!

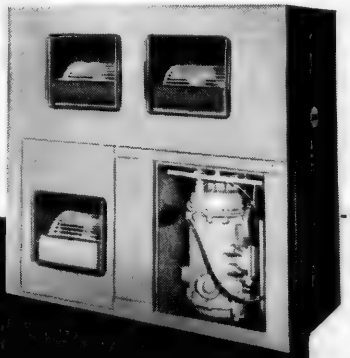
"Packaged" Air Conditioners in six water-cooled models, from 2 to 15 H.P.

● A Chrysler Airtemp "First", the famous radial compressor permits perfect balance. Rubber compressor suspension and flexible connections in suction and discharge lines further reduce noise and vibration. Combined, these features assure such quiet operation you can install a Chrysler Airtemp "Packaged" Air Conditioner within or very close to the area to be cooled. Thus ductwork is eliminated or greatly minimized to cut your installation costs.

All units are shipped *completely* factory-assembled. To facilitate installation, you have a choice of three different ways of directing the conditioned air. You can even "split" a unit, placing compressor assembly on floor and balance above shelving or other fixed objects.

Easier, faster installation saves costly man-hours, gives you an important competitive advantage. But it's only one of many big reasons why it will pay you to sell Chrysler Airtemp! Check seven of these reasons in list at right . . . then mail coupon for complete details.

Guaranteed by Good Housekeeping



New "Packaged" Air-Cooled Air Conditioners— *no water needed,* no plumbing required. 2, 3 and 5 H.P.

CHRYSLER AIRTEMP

heating • air conditioning for homes, business, industry

Airtemp Division, Chrysler Corporation, Dayton 1, Ohio

7 more advantages you sell with when you sell Chrysler Airtemp . . .

- **Consumer Confidence**—people know the Chrysler Airtemp name—associate it with engineering leadership—have confidence in the products which carry it.
- **More Units in Use**—Chrysler Airtemp pioneered "Packaged" Air Conditioning in 1937, has more units in use today than any other manufacturer.
- **Advanced Engineering** by Chrysler Airtemp offers your customers features that mean more because they do more for them.
- **Assured Dependability**—all units manufactured to exacting standards of precision in a windowless, completely air conditioned factory. Each unit is thoroughly inspected and tested, using special equipment and methods, to assure dependable performance in the field.
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Airtemp Division of Chrysler Corporation H&V-3-54
P.O. Box 1037, Dayton 1, Ohio

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Check the reasons why the popular choice for summer cooling and winter heating is

the individually-controlled unit that filters and circulates the air all year 'round in central-plant, multi-room installations

Architects, builders and heating contractors like the Remotaire because it's versatile, easy and economical to install, space saving.

Building owners like the Remotaire because it provides healthful, draft-free comfort conditioning all year 'round with minimum attention.

- Same simple piping circuit supplies chilled water for summer cooling, hot water for winter heating. No unwieldy ductwork needed.
- The Remotaire is adaptable to the best system for the job—Wall Aperture System, Interior Ventilation System, Well Water System, Split-coil System, Motel System, Residential System, Modernization System.
- Units can be installed recessed, partially recessed or free-standing.
- Three popular sizes to choose from—200, 400, 600 cfm. A size for every job.
- Easy to service. Every part of the assembly can be reached easily, quickly.
- Easy to maintain. Motor assembly can be taken out and replaced in less than 15 minutes.
- Reversible coil is designed for right or left hand connection. Easily reversed in the field.
- Special electrical junction box is easy to get to.
- Sturdily built . . . doesn't have to be pampered in installation. (Reinforced grille will support weight of 200 lb. man!)
- Each unit is individually controlled . . . temperature in each room can be changed without affecting adjoining space.
- The Remotaire is quiet. No whistling-jet noises.
- Handsome jacket, furnished in semi-gloss Cooltan, can be painted any color.
- Toe-step offset permits better fitting of rugs around units and eliminates marring of front when cleaning floors.
- Drain pan protection. Large pan runs entire length of unit to prevent condensation drip. Grille shield prevents foreign matter from entering through top.
- Large filters . . . keep air fresh and clean.
- Adjustable damper. Amount of air intake can be changed at any time.
- Wall seal. Rubber molding around back panel provides air seal between unit and uneven plaster.

For further information on the Remotaire see Sweet's Architectural File or contact your nearest American-Standard sales office for descriptive literature.

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HEATING-COOLING SYSTEMS

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The measured precision found in every B&W Boiler Tube makes for ease of fabrication in boiler applications. Of particular importance in expanding operations, this unerring uniformity exists throughout the entire tube length. From end-to-end, the strength of the tube is constant. Further, the electric resistance welding process used in the production of B&W Welded Boiler Tubes insures that the weld is as strong as the strip from which the tube is made. Performance in service, the true test for any product, has proven that B&W ERW Boiler Tubes pay their way . . . longer and with an evenness of operation that means long-run savings for you.

For three quarters of a century, B&W has been directly concerned with developing and applying boiler tubes for all pressures up to those approaching 3000 psi. The application of this extensive knowledge and experience results, naturally, in the production of finer welded boiler tubes.

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LOOK FOR THIS

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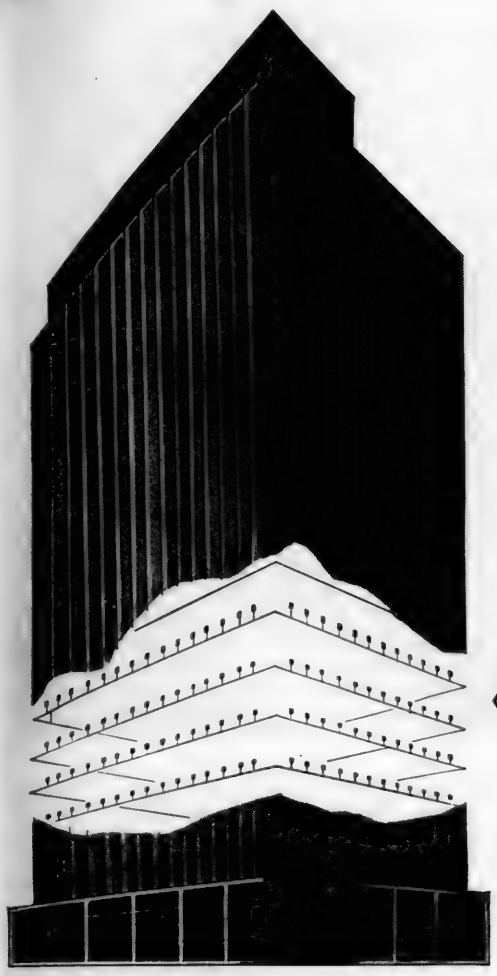
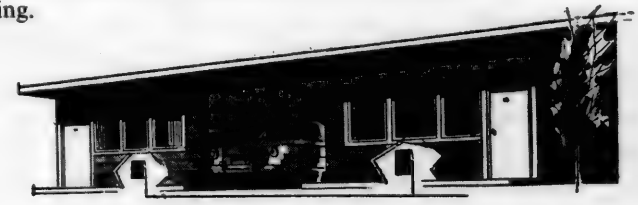


Modulated Heat with Thermostat in Every Room

Every room in a building is an individual zone, with its own thermostat. Every room is heated with filtered warm air, continuously circulated by a compact, recessed wall unit. Sets a new standard of comfort and heating economy for every type and size of residential, institutional and commercial building.



SelecTemp Highlights

THERMOSTAT IN EACH ROOM. Temperatures can be varied in every room to fit the "activity plan" and personal preference of the occupants.

MODULATED HEAT. Air circulation is continuous. Both temperature and volume of air is automatically modulated, as required to offset heat loss from room.

FILTERED, CIRCULATED AIR. Individual room air circulation prevents transmission of odors or bacteria from other rooms. Air is cleaned by a spun glass filter in each room unit. Filtered outside air can be introduced if desired.

BOILER LOCATION. Does not require centrally located heating plant. Boiler can be placed in any desired location, with proper distribution of heat to every room.

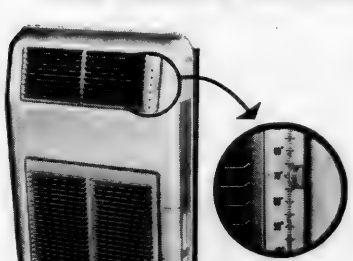
LOW POWER COST. No electricity required to operate circulating fans. Nonelectric thermostats.

LOW INITIAL COST. No other system can be so easily installed in either new or old construction. Small soft copper tubing (¼ inch I.D.) carries steam to individual room heater units. Return lines are ⅜ inch. Tremendous savings in installation costs.

LOW FUEL COST. Temperature easily reduced in unused rooms. Eliminates overheating.

AUTOMATICALLY BALANCED. No special adjustments of dampers, valves or orifices required to balance heating system. Each unit continuously regulates heat needed for each room. Automatically compensates for external heat sources such as fireplace or solar heat, without affecting temperatures of other rooms.

FOR LARGE OR SMALL BUILDINGS



Individual room control with continuous modulated heat

With SelecTemp heating, every room in the building is an *individual zone*, with its own thermostat. Low pressure steam, supplied to recessed wall units through small flexible copper tubing, provides heat and power for the circulating fan. Thermostats are nonelectric and require no wiring.

Exact, constant temperatures

Each room thermostat may be set at any temperature from 40 to 90 degrees. Heat in each room is accurately maintained at the temperature selected. The thermostat detects any change in temperature and regulates both the speed of the circulating fan and the steam supply to exactly meet heating requirements. SelecTemp thus eliminates ordinary on-and-off cycling and "cold 70" stratification. It constantly modulates from 1/20th of capacity to full capacity, supplying just the amount of heat needed. SelecTemp compensates automatically for variations due to changes in outdoor temperature, and in velocity and direction of the wind. It compensates for heat gains from the sun's heat, fireplaces, cooking ovens and body radiation.

Low installation and operating cost

The various parts of the selecTemp system are engineered for rapid economical installation without time wasting special provisions. SelecTemp units are delivered assembled in steel enclosures for mounting in wall stud spaces or wall openings. No electric power required for operation of circulating fans or thermostats—an important saving. Fuel savings result from elimination of wasteful overheating and from lower temperatures in unoccupied rooms. Small steam lines greatly reduce heat transmission losses.

SelecTemp
TRADE MARK
PRODUCT OF IRON FIREMAN

Send for full information

IRON FIREMAN MANUFACTURING CO.
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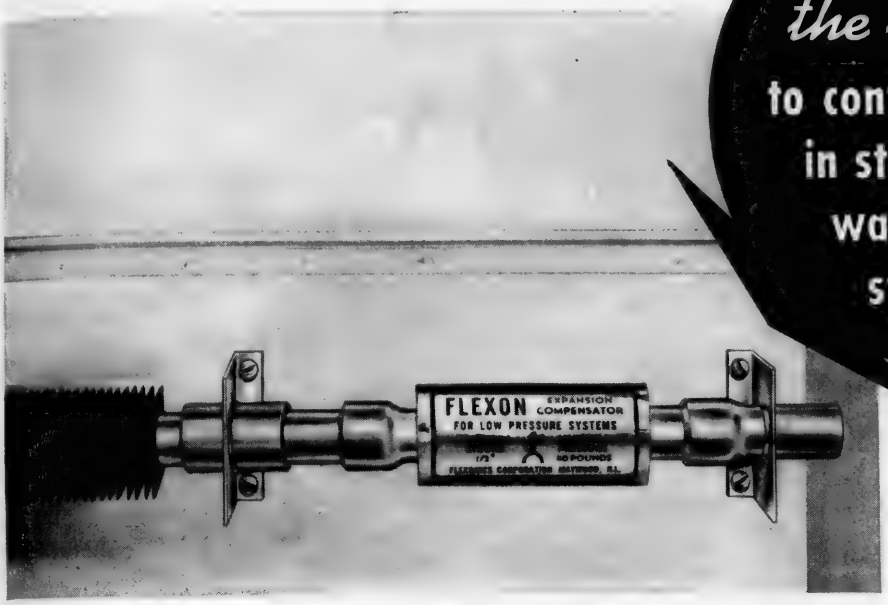
Here's the right way to control expansion in steam and hot water heating systems...



THE *New* FLEXON EXPANSION COMPENSATOR...

DESIGN DETAILS

The Flexon Expansion Compensator consists of a two ply phosphor bronze bellows with copper tube end connections (sizes ¾" to 1¼") enclosed in a floating protective shroud of brass. All joints are electronically sealed with silver solder for long leak-proof life. The 2" size is especially guided and has standard threaded fittings. A single compensator will handle total piping motion up to ⅝" (½" in compression, ⅛" in extension). Suitable for temperatures from —60° F. to 250° F. and for pressures up to 40 psig.

Control of thermal expansion in low pressure steam and hot water heating systems need not be a headache any longer. The new Flexon Expansion Compensator provides a practical, economical answer to the problem. Designed especially for finned type convectors, baseboard, radiator or heating supply or return lines, the Flexon Expansion Compensator is ideally suited for use in homes, office buildings, schools or any buildings where expansion in heating piping is a problem.

The Flexon Expansion Compensator is practical because it puts an end to leakage that often results from uncontrolled expansion and eliminates objectionable pipe creeping noises. It is economical because it is designed to outlast the building and requires no maintenance whatsoever. Just install it and forget it.

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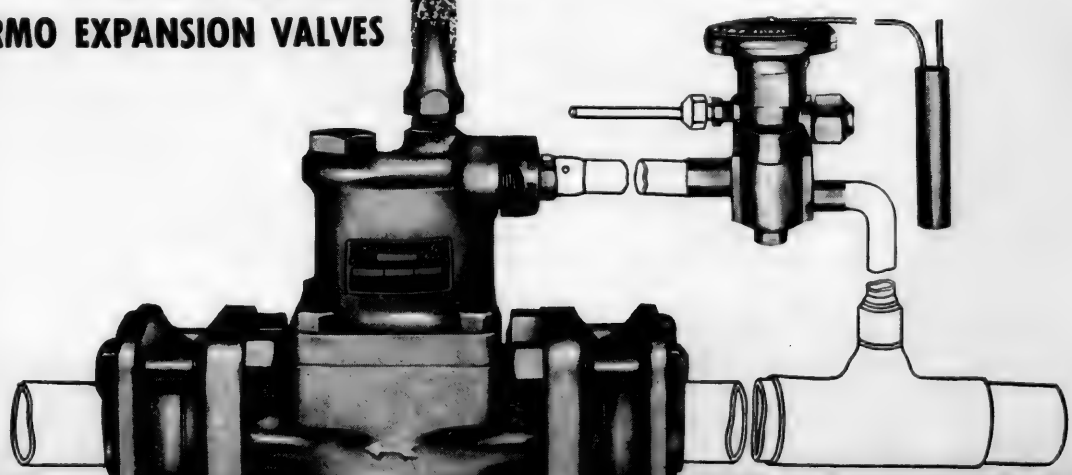

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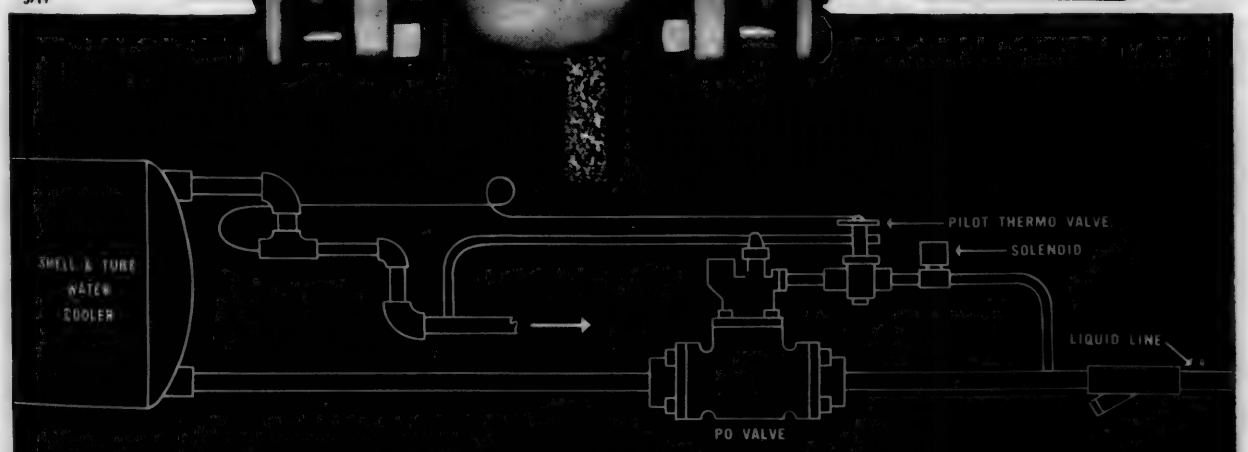

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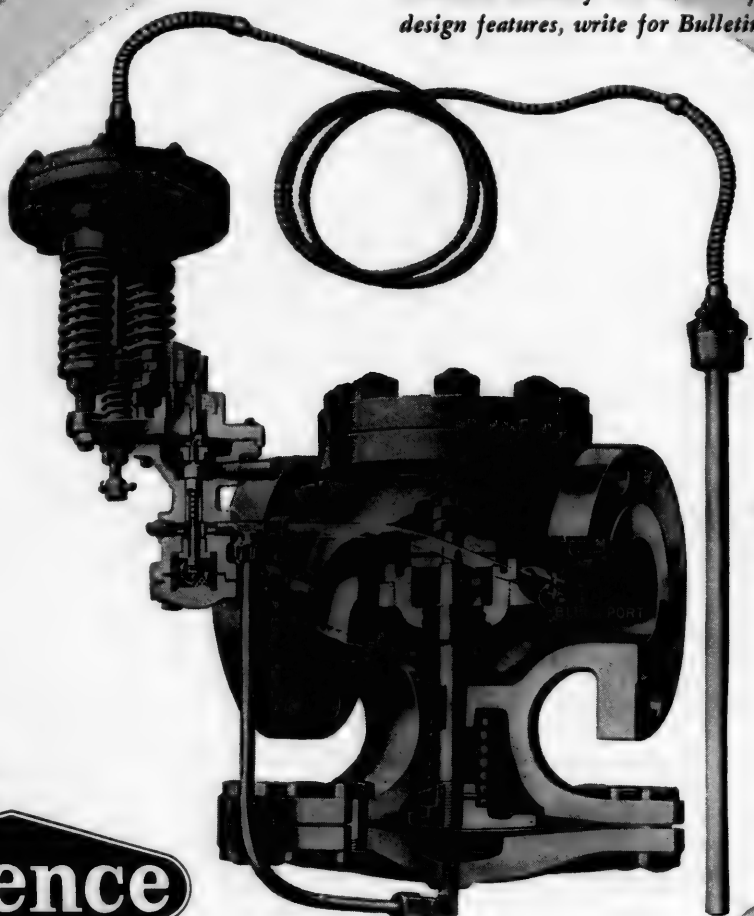

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McQuay SEASONMAKERS

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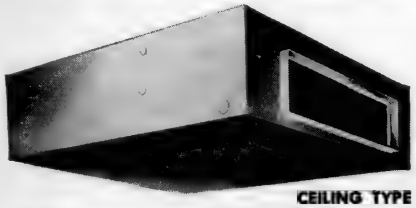
For free standing mounting beneath a window or along a wall.



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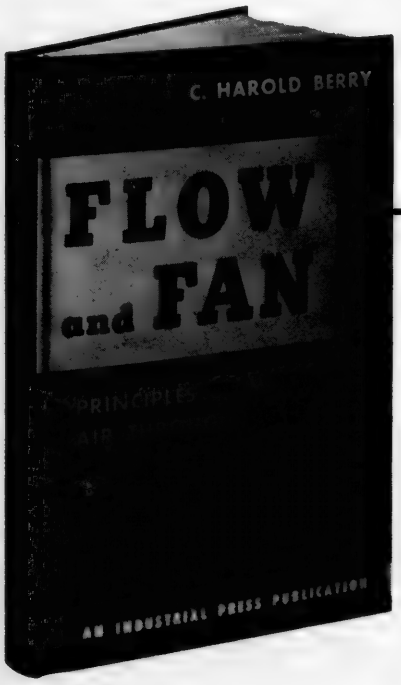

A BASIC TEXT ON AIR HANDLING

By C. HAROLD BERRY,
Gordon McKay Professor of Mechanical Engineering, Harvard University

"Flow and Fan" will help you solve your problems of moving air through ducts, and the selection and control of fans. It covers the *how* and *why* behind the basic calculations in the design of systems, giving information that is applicable to the actual problems you meet in ventilating work.

The title is derived from the two major divisions of the book: the *flow* of gas through duct systems, and *fan* performance and control. Seven chapters on gas flow give the basic data you need and describe the methods used for calculating system resistance. The final six chapters are devoted to information that will help you in the practical task of selecting a fan for a given duty. Because of this treatment, "Flow and Fan" will meet the needs of students who are interested in acquiring a working knowledge of ventilation, and will be useful to practicing engineers as well.

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HV-3/54

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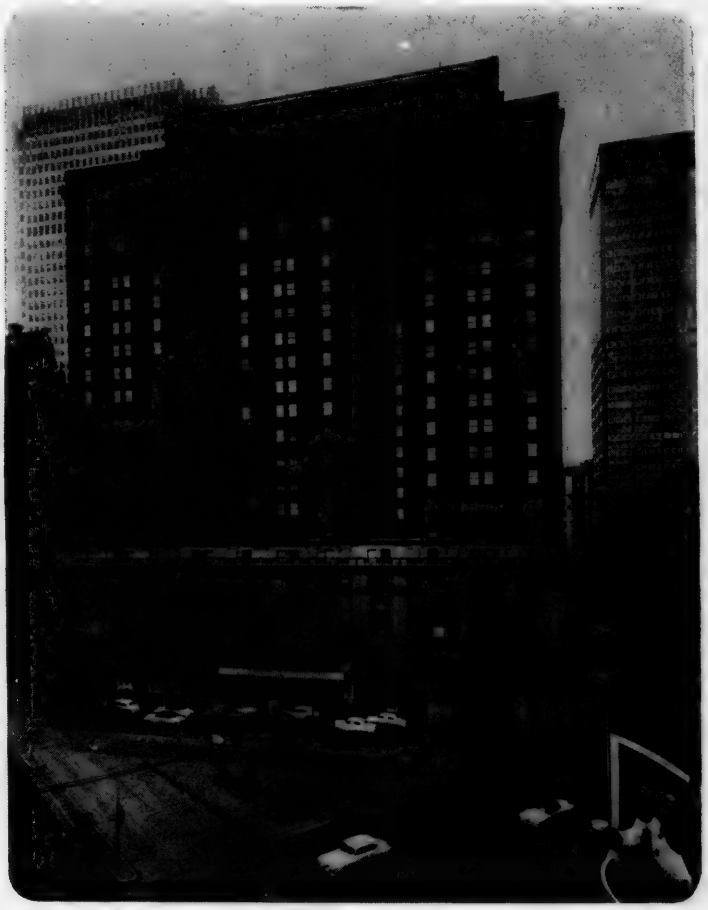
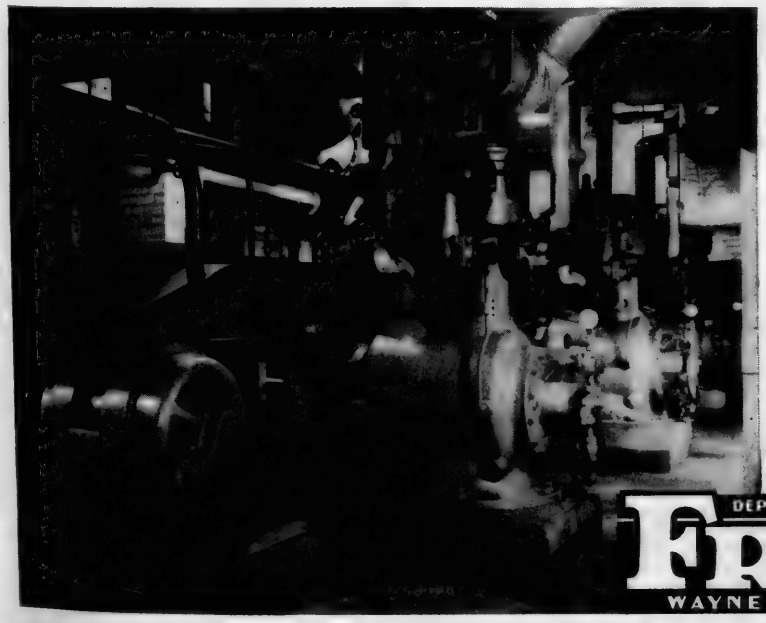


These include air conditioning, cooling drinking water, refrigeration of foods, freezer service, and making ice. This magnificent hotel has used Frick equipment since 1936, and finds it both efficient and dependable. Three of the four Frick compressors are shown below.



The buildings in which you are interested can likewise profit by using Frick Equipment. We make air conditioning units and central systems; compressors handling Freon-12, ammonia, and other refrigerants; condensers, coolers, coils; freezers, ice makers, ice reserve units; piping, valves, fittings, controls, and special equipment.

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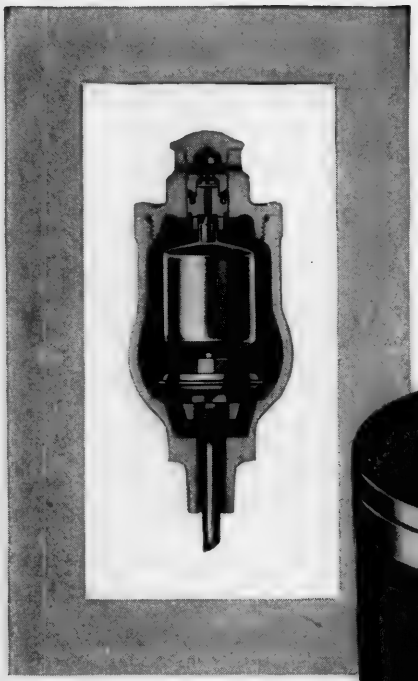

A well placed air vent can work a heating miracle!

No. 5 Rapid Vent. Float and thermostatic construction. Designed for use at the end of steam mains, tops of risers and other similar locations on vapor and one pipe vacuum systems where the maximum venting requirement does not exceed one cubic foot per minute at 5 psi.

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Marsh air vents are fully covered by the Marsh Heating Specialty Catalog along with Marsh Traps and Valves. Your local Marsh man will be glad to work with you in applying Marsh Vents effectively.

No. 50 Air Vent. Float only. Designed to remove air and gases automatically from hot or cold water tanks, coils or piping, liquid pump systems or similar applications where it is necessary to vent air rapidly. Maximum working pressure, 125 psi.

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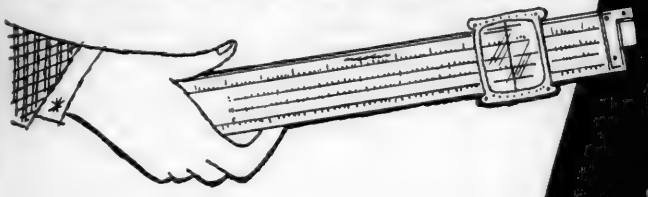

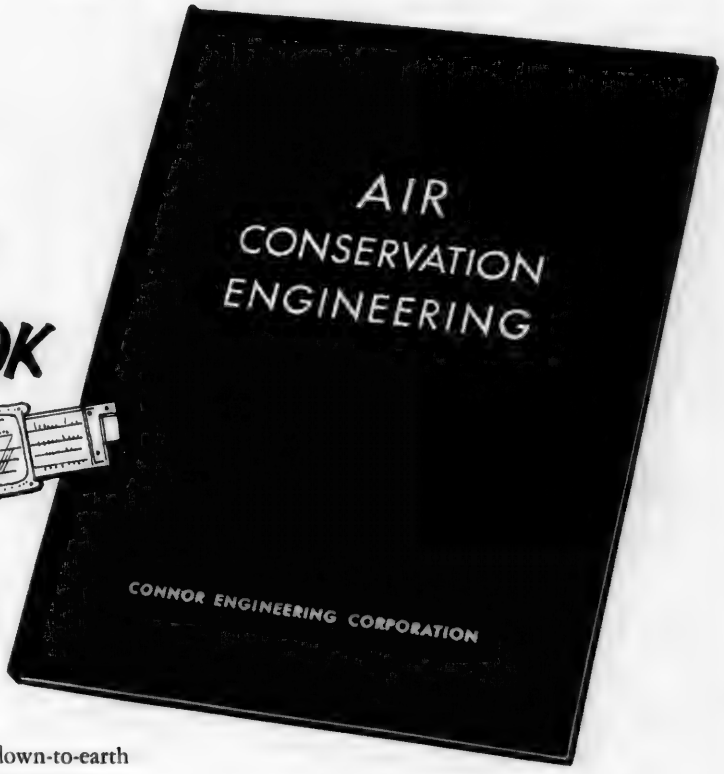

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Fig. 2651-A Gate

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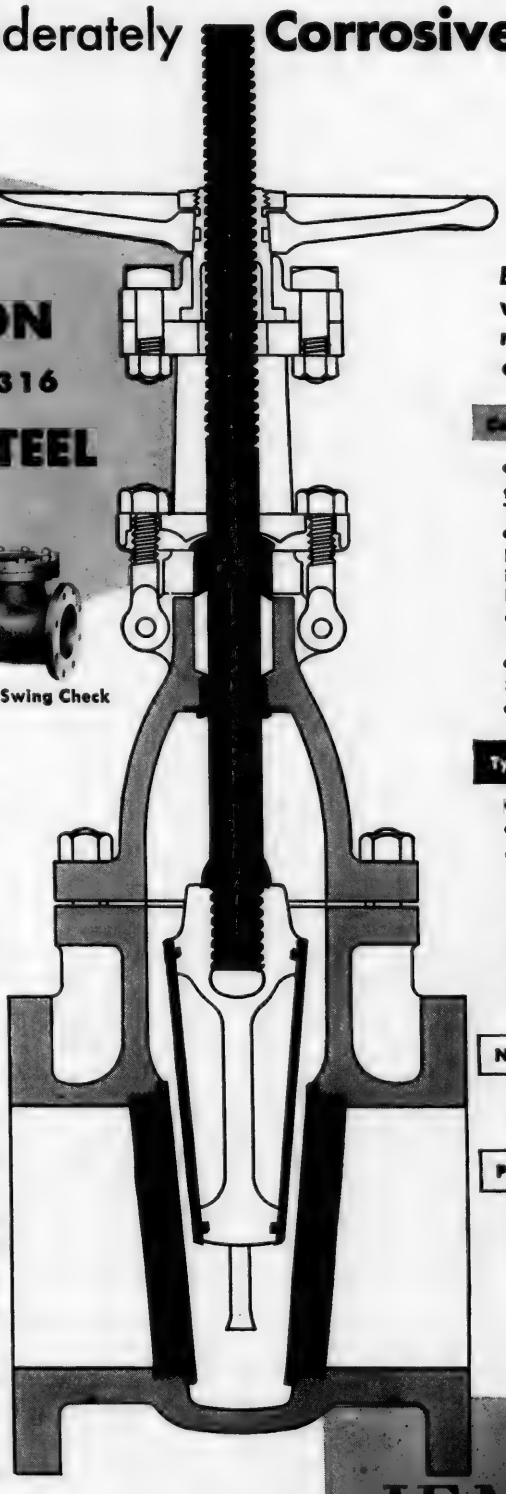
Valves with Type 316

STAINLESS STEEL

Trim

Fig. 2624 Swing Check



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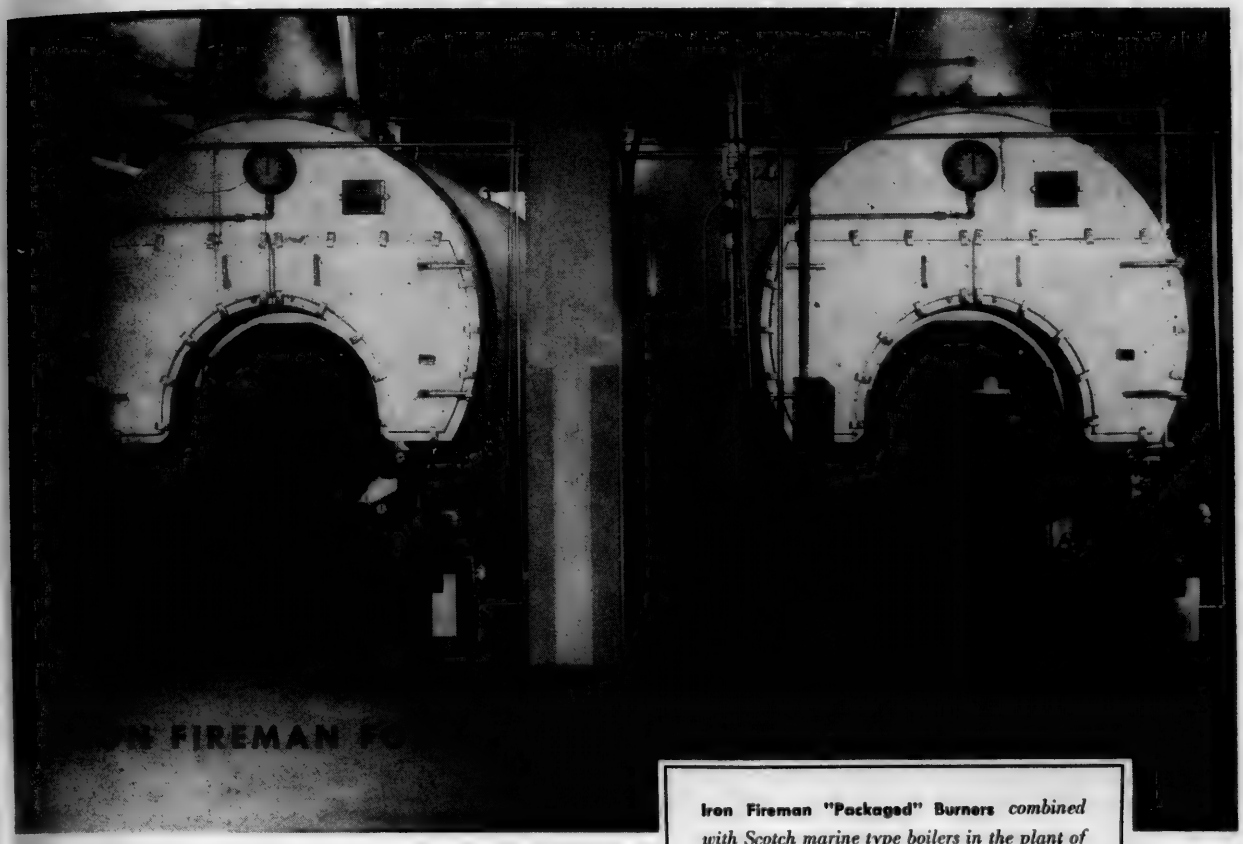

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How a warm water heat source and cold river heat sink combined to make an unusual job the logical answer to heating and cooling a power station in the Pacific Northwest.

An 80-Ton Water-To-Air Heat Pump

THOMAS H. SEITZ

Senior Mechanical Engineer, Sverdrup & Parcel, Inc.
San Francisco, Calif.

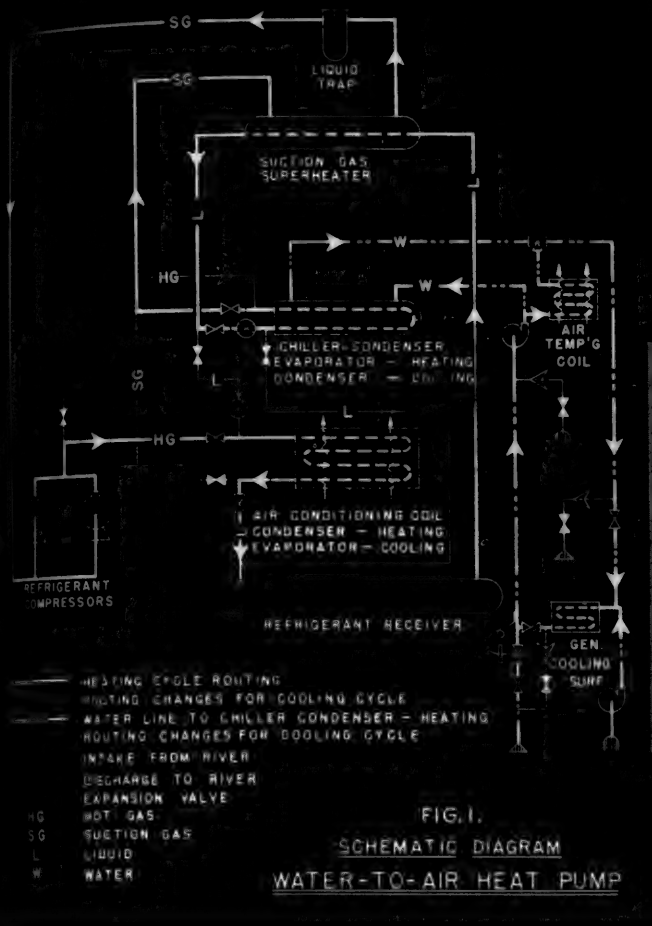


FIG. 1.
SCHEMATIC DIAGRAM
WATER-TO-AIR HEAT PUMP

APPLICATION of the heat pump refrigeration cycle to the heating of a hydro-electric powerhouse represents a somewhat out-of-the-ordinary approach, but may prove practical and economical where warm water is available for a heating cycle heat source, and climatic conditions warrant summer cooling. This permits year around utilization of the refrigeration equipment. The availability of comparatively cold river water to serve as a condensing medium and possible utilization of skilled personnel on a part time basis for operation and maintenance of equipment are important economic considerations. The application of these principles to a relatively large installation in the Pacific Northwest for which heating and summer cooling were specified is outlined in the following paragraphs.

Generator cooling water at 67F to serve as a heating cycle heat source, and river water at 70F or less for use as a cooling cycle condensing medium, will be available These water temperatures are very favorable to high coefficients of performance for both heating and cooling cycles.

A schematic arrangement of the 80-ton water-to-air heat pump installation is shown in Fig. 1. Two identical Freon-12 compressors will operate on a cycle of heat absorption in the tubes of a water chiller, to condensation and heat rejection in the tubes of a coil in the central system air stream, during the heating cycle. The cooling cycle will be the reverse, consisting of direct expansion in the air stream coil and heat rejection by condensing in the tubes of the water chiller.

Utilization of the cooling water from the main generators, in effect, accomplishes the heating of the structure by waste heat from power losses in the generating equipment. The function of the refrigeration compressors during the winter cycle is to extract heat from the generator cooling water and to increase the temperature of the extracted heat to a sufficiently high level to permit efficient heat transfer to the central system air stream. Some complication is introduced into the generator cooling water circuit by the need for a recirculation system that will "fail safe" and will assure an adequate cooling water supply at a nominal temperature under all likely operating conditions.

The characteristics of the heating and cooling loads dictated the grouping of the powerhouse spaces into five zones. To keep the refrigeration piping as simple as possible and to permit the operating cycle of the compressors to be as uniform as feasible, a multi-zone, or "hot and cold deck," system was chosen for the central plant. The arrangement differs from the conventional multi-zone system in that it has only one coil and conditioned air plenum instead of separate coils and plenums for heating and cooling. The coil provides heated or cooled air, at the operator's option, to the conditioned air plenum. The balance of the mixture of outside and return air bypasses this plenum and is mixed in proper proportions with the conditioned air at the zone mixing dampers, which are positioned by a return air thermostat in each return duct. This complicates the mixing damper and the control arrangement to a certain extent, but avoids duplication of an expensive coil (10 ft by 5 ft by 8 rows) and reduces the size of the plenum since higher velocities can be used through the by-passed air passage than would be feasible over heat transfer surface to a plenum.

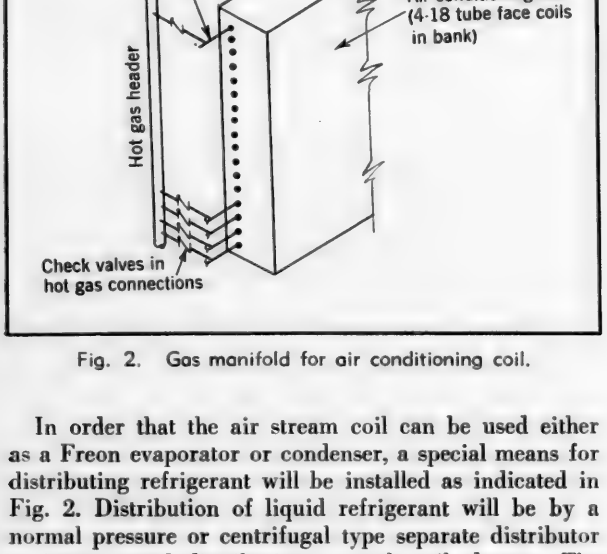

Coil connections to external distributor
Air conditioning coil (4-18 tube face coils in bank)
Hot gas header
Check valves in hot gas connections

Fig. 2. Gas manifold for air conditioning coil.

In order that the air stream coil can be used either as a Freon evaporator or condenser, a special means for distributing refrigerant will be installed as indicated in Fig. 2. Distribution of liquid refrigerant will be by a normal pressure or centrifugal type separate distributor to insure equal distribution to each coil element. The pressure drop through such a distributor would, however, be excessive when using the coil as an air cooled condenser. A header arrangement has therefore been designed to distribute hot gas with low pressure drop, distributing the gas to the refrigerant distributor leads through a tee connection at each coil element inlet. A check valve will be installed at each header branch so that on cooling cycle service, the liquid refrigerant cannot by-pass through the header, imparing the effectiveness of the liquid distributor. When evaporating F-12, the pressure drop in the distributor creates no problem except for dictating a slightly larger expansion valve than would otherwise be required, but on condensing service this same pressure drop would considerably increase compressor work and become a cause for concern on a large capacity system.

Further economy was made possible by designing the water chiller to operate as an in-the-tube condenser in summer rather than furnishing a separate condenser for this purpose. The feasibility of so doing is peculiar to the conditions of this particular project. It was noted that river water would be available in summer at less than 70F, and that if the direction of flow of condensing hot gas were reversed from the direction of liquid refrigerant flow in the water chiller, the number of tubes per pass decreased at a suitable rate to maintain a mass velocity which, in combination with the favorable water temperature, would yield a satisfactory combination of heat transfer coefficient and effective temperature difference to meet the load requirements. This routing also makes the chiller tube nest free-draining, which is of course vital to condensing operation. Utilizing this scheme, a simple refrigerant receiver can be substituted for the normal condenser-receiver and all pieces of equipment will be fully utilized during both the heating and cooling cycles.

The use of the water chiller for both refrigerant evaporation and condensation posed some problems in regard to control of water supply to the chiller shell. The water supply will be controlled by a three-way valve operated by a differential temperature controller with bulbs at the water inlet and outlet of the chiller shell as indicated in Fig. 3. During condensing service, the controller must increase the water supply on increase in temperature rise between inlet and outlet, whereas on evaporator service the controller must increase the water supply on increase in temperature drop between inlet and outlet. The controller itself is easily shifted from direct to reverse acting, but at the instant of shift from one cycle to the other, the temperature difference at the controller bulbs is such as to cause the three-way valve to completely stop flow of water through the chiller. This condition is perfectly reasonable for the first few moments of operation, but there would be no assurance that a proper differential would ever be established unless flow were maintained in some way. To obviate any control difficulty from this cause, the design provides for a fixed by-pass around the three-way water valve to insure a smooth shift from cooling to heating cycle and vice versa.

It will be noted in Fig. 1 that the design provides for the installation of a liquid trap downstream of the refrigerant heat exchanger suction gas outlet. At the moment of transfer from heating to cooling cycle or vice versa, the chiller and the air coil will suddenly interchange their functions of condenser and evaporator service, consequently their positions with respect to compressor suction and discharge are reversed. Conservative caution would justify the assumption that equipment so shifted in service may be relatively full of liquid. The liquid trap is designed to contain this liquid refrigerant and prevent its slugging back to the compressor under the impetus of the sudden pressure decrease. The liquid may then gradually re-evaporate into the suction line, after which the compressors will again carry the load normally. Oil separators will be installed in the compressor discharge lines to discourage the liquid trap from also becoming an oil trap, and as an additional precaution, a sight glass and drain will be provided at the liquid trap.

The refrigerant heat exchanger was sized on the basis of required heat exchange to avoid flash gas at the expansion valves in consideration of hot gas and liquid line pressure drop and elevation difference between receiver and the expansion valves. The heat exchanger thus selected was checked to determine whether or not it had sufficient volume for storage of liquid to avoid possible slugging. The volume was found to be insufficient, but rather than increasing the size of the heat exchanger, it was found to be more economical to provide a liquid trap as indicated.

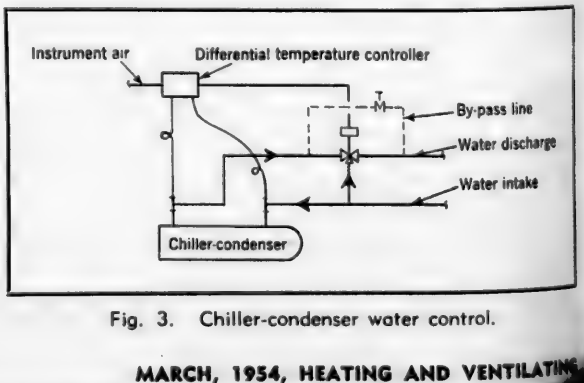


Fig. 3. Chiller-condenser water control.

Thomas H. Seitz is senior mechanical engineer in the San Francisco office of Sverdrup & Parcel, Inc., consulting engineers. His specialization is in the field of heat transfer and thermodynamics. His work involves the steam and process industries, hydroelectric plant design, and industrial and comfort air conditioning.

Mr. Seitz is a graduate of the U. S. Naval Academy in 1937. He spent four years as an engineering officer after graduation and during World War II. His experience includes four years in the heavy construction field, four years in operations, and eight years in design. He joined Sverdrup & Parcel, Inc., in 1948.

The process of shifting the system from heating to cooling cycle and vice versa is to be manually initiated, due to considerations peculiar to the project. The design, however, calls for complete interlocking of the main valves controlling refrigerant routing. This feature is considered to be of vital importance to the successful operation of the system since misrouting of refrigerant in a system of this size may damage the compressor equipment, and at best would result in an unbalance which would take some time to rectify. The system is also sufficiently complex that it is not considered reasonable to expect an operator to manually shift the necessary valves in proper sequence to avoid dropping the load. This philosophy is carried through to provide simultaneous transfer of electrical and pneumatic controls from one cycle to the other by shifting a single manual control lever, primarily as a matter of convenience. The interlocking of the refrigerant control valves is accomplished quite simply by installing a solenoid in the pneumatic main to each group of valves. The circuit to this solenoid is completed through a series connection of micro-switches on the valve stems, so that air pressure is available to operate summer-cycle valves only when all winter-cycle stems are in the fully closed position. When all valves are closed, both solenoids are energized and any valve may be operated, but as soon as one valve on a given cycle is opened, only the remaining valves on that cycle are operative, the off-cycle air supply having been automatically cut off. This arrangement has the added feature of safe failure since the refrigerant valves are spring closed so that any failure of air supply or electrical supply will immediately close all valves on both cycles and shut down the entire system.

Dependability of operation and standby protection are requirements in a heating system for this type of building. Standby electric power from the distribution system is available, so electric, resistance type, strip heaters of capacity equal to approximately one-third the design load of the heat pump have been provided. This capacity, plus lighting and equipment load, can maintain the powerhouse above freezing temperatures. In recognition of this condition, a three-circuit water chiller is provided. This permits carrying the full design heating load with one chiller circuit shut down, by using the emergency strip heaters for tempering the air. The air stream heating and cooling coil is to be made in four sections (for reasons other than standby protection), and one section can be removed from service and still maintain the design heating load if the emergency strip heaters are used. The refrigeration compressor capacity is divided between two units so that 50% capacity can be maintained with one machine shut down. Some standby protection is obtained by utilizing a portion of the water supply to the chiller for tempering the incoming air supply. This use can continue in the event the chiller is shut down.

The factors discussed are intended to present some of the interesting problems encountered in heat pump design. General design has not been covered, but it is hoped that the somewhat unusual features herein presented will be helpful to those concerned with the design of systems of this nature.

Georgia Hospital Air Conditioned

The benefits of air conditioning for modern hospitals are illustrated in newly-erected St. Joseph's modern Hospital, Augusta, Ga. In this modern hospital, operating rooms, x-ray and delivery rooms, the nursery and pediatrics ward are maintained at ideal temperature conditions the year-around.

Heart of the central station duct system is a Chrysler Airtemp 40-hp dual radial water chiller. A network of large air ducts distributes the tempered air throughout the air-conditioned area.

In year-around operation, chilled water or steam is pumped to an air washer where the air is blown through for cooling or heating. The air then is passed over a reheat coil where proper humidity is maintained. From the reheat coil, the air is passed through an electrostatic precipitator then into the central air distribution system.

In the winter cycle, a humidistat located in the exhaust duct resets a dewpoint thermometer (normally set at 61F) to produced the desired humidity. (55 percent in the operating and delivery suites and 50 percent in the nursery, x-ray and pediatrics areas.) It regulates the re-heater steam valve, which oscillates from three to six pounds, while holding the cooling valve closed to cooling water. When outside air temperature descends below 70F, the outside thermostat resets the delivered air thermostat to 68F in the winter.

If necessary, the air is reheated by the booster coil, which is controlled by one of the seven room thermostats, through a valve to maintain 76F drybulb. As either drybulb or humidity conditions vary, the system automatically switches over to summer control.

In the summer cycle a humidistat resets the dew-point thermostat to a lower temperature, which causes a valve to close as water pressure increases to seven pounds. Thereupon the controls are actuated to start the air conditioning equipment and open a three-way valve, oscillating from seven to twelve pounds, to cooling water, thus maintaining dew-point and relative humidity.

When the outside air thermostat reaches 78F it resets the discharge thermostat to 63F which regulates the reheat valve. If necessary, the air is then reheated by the booster coil under the control of one of the seven room thermostats through the valve to maintain 78F. If the equipment is not capable of maintaining this temperature due to temporary excessive local conditions, it will be out of control on dry bulb. But even under such maximum conditions, a room temperature of 80F will not be exceeded.

Refrigeration for Fur Storage

Accepted procedures for the satisfactory storage of furs and how to calculate for the heat load in storage rooms are explained by engineers of the York Corp., York, Pa.

SINCE it is only natural for the owners of fur garments to wish to prevent deterioration, refrigerated fur storages came into being as a means of protecting these valuable items of wearing apparel during the warm seasons when they are not in use and are most susceptible to damage by destructive pests and deterioration. Moth larvae, which are considered the worst natural enemy of furs, are inactive during the winter months but become very industrious during the summer. Moth life will consume the fur, and if the pelts dry out, they may be ruined.

Garments that have remained in cold storage continuously for many years are in excellent condition and are as good as new. The pelts are soft and pliable, and their vitality and luster is well preserved. There is countless testimony to this effect.

The objective of fur protection by refrigerated fur storage is:

(1) To prevent destruction by moth larvae and other insects.
(2) To prevent drying out of the natural oils in the skins, thus maintaining their softness and flexibility.
(3) To preserve original strength of the pelts.
(4) To preserve natural luster of the furs.
(5) To prevent oxidation of the dyes.
(6) To protect against fire and theft.

In fur storage applications, there are four methods used to destroy moths, moth larvae and moth eggs:

(1) Low temperature shock treatment at intervals during the storage period with a normal cold storage temperature carried the balance of the time.
(2) Fumigation before the garments enter the vault with the storage carried at a normal cold storage temperature.
(3) Fumigation at regular intervals with the vault carried at normal cold storage temperature.
(4) A fumigated vault with no refrigeration.

Furriers advise their customers to observe the necessity for cleaning and glazing as frequently as the particular fur requires, to prolong the life and beauty of the garment. This is also necessary for fur trimmed apparel. The general practice is to clean, or clean and glaze, before the garments are put into storage.

Although this article deals primarily with furs, other valuable items such as Oriental and other carpets, tapestries, draperies and similar *objets d'art* are stored in refrigerated fur vaults.

TABLE 1.—DAYS OF EXPOSURE REQUIRED TO KILL

Temperature, F	Eggs	Larvae	Adult Moths
	Days Exposure to Kill		
0- 5	1	2	1
5-10	2	21[a]	1
10-15	4		1
15-20			1
20-25	21	67	4
25-30	21	125[b]	7
30-35		283[c]	

a From 50% to 95% of larvae may be killed in two days.
b A few larvae survived this period.
c Larvae survived this period.

Need for Refrigeration

Three of the methods generally used in fur vault applications, as previously mentioned, employ refrigeration to maintain proper storage temperatures. Proper humidity also plays an important part in the storage of furs and humidity control can be made part of the refrigeration system.

The refrigeration shock method is generally accepted as the most economical treatment for providing all the desired features and conditions for properly storing furs and fur garments. Refrigeration may be used in conjunction with fumigation. However, fumigation alone meets only part of the requirements since it kills moth life but does not prevent the peltry from drying out and otherwise deteriorating from their original condition.

A refrigerated fur storage vault can be profitable to department stores, retail furriers, dry cleaning establishments and laundries.

Extensive investigation by the Bureau of Entomology, United States Department of Agriculture, indicates that moth larvae are entirely inactive at temperatures of 40F or less but become increasingly active above 40F, reaching maximum activity at temperatures above 55F. Results of studies on moth life, shown in Table 1, clearly indicate the effects of temperature on this destructive pest. It will be seen that moth larvae can survive at temperatures of 30 to 35F for a longer period than the average summer, and moth eggs live as long as several weeks at 25 to 30F.

Methods of Storage

The four methods used in fur storage application for the destruction of moths, moth larvae and moth eggs are:

Shock method of refrigeration. This has proved that quick temperature changes alternating from cold to warm and back to cold again will destroy moth life rapidly. In the shock treatment the storage temperature, normally held at 40F, is quickly dropped to and held at 15F for three or four days, raised to 45 to 50F for one or two days, lowered again to 15F for one or two days, and finally returned to the normal storage temperature of 40F. The shock treatment is repeated several times during the early part of the storage season and insures positive de-

struction of moths, larvae and eggs. In addition to the destruction of all moth life, the shock method offers positive temperature and humidity control which preserves the pelts in their natural condition. No fumigants are used, the vault can be entered at any time and no special precautions are necessary from this standpoint.

Use of fumigation chamber. This method employs a fumigation chamber outside the storage vault. All garments are fumigated for 48 hours or more before being placed in storage. The fumigants used include: Hydrocyanic acid gas, carbon disulfide, carbon tetrachloride and various insecticidal sprays. The refrigerated vault in which the garments are stored is maintained at a constant temperature of 40F.

Constant low temperature storage. The storage vault is held at a temperature of 40F in some applications and as high as 65F in others. The vault is then fumigated at regular intervals during the entire storage period. In this practice the insect eggs will develop into larvae which are killed by the fumigant.

Storage without refrigeration. Such storage loses the benefits of lower temperatures in preserving the natural condition of the pelts. Calcium chloride or some other moisture absorbent is used to prevent extreme humidity. The vault is fumigated during the entire storage period to destroy the moth life.

It is important to stress the following experience of the National Association Institute of Dyeing and Cleaning, Incorporated:

(1) The strength of peltry decreased as much as 12% when storage conditions were 90F DB and 42% RH but retained their original strength when stored at 40F DB and 42% RH.

(2) The strength of peltry decreased as relative humidities increased. The amount of deterioration was approximately 7% when held in storage at 76% RH as compared to 32% RH.

(3) The percentage of natural oils remaining in peltry was approximately 98% in cold storage as compared to 90% in fumigated storage without refrigeration.

(4) The percentage of natural oils remaining in peltry was approximately 83% when stored at 76% RH as compared to approximately 100% at 32% RH.

Design Data

Design temperatures for the shock method of fur storage are 15F for the shock period and 40F for the normal storage period. When calculating the heat load, the cooling of the product should be included in the shock pulldown load. In the absence of definite information on the weights and specific heats of furs, a value of 30 Btu per cubic foot of internal storage volume per 24 hours may be used to determine the load for product, lights and occupancy.

Equipment selection analysis requires a knowledge of the proper design relative humidity and load multiplier for the vault. For the normal storage, it is satisfactory to design for a relative humidity within the limits of 40 to 60%, and for a multiplier of 1.10 to 1.15. The multiplier is a factor employed to simplify design calculation. By definition it is the ratio of sensible plus latent load to sensible load.

For the low temperature load during the shock period, it is difficult to effect an equipment balance and adhere to the recommended relative humidity and multiplier. Since the absolute humidity at 15F dry bulb temperature is relatively low, the design relative humidity for the shock period may be increased as required when making equipment selection.

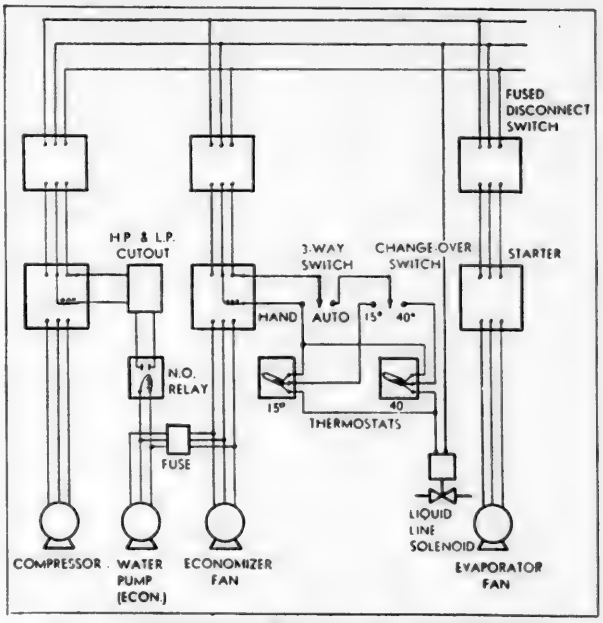


Fig. 1. Typical wiring diagram using two thermostats.

For the shock method of refrigeration, satisfactory controls should be installed to permit the operator to cycle the equipment with ease. The wiring diagram of Fig. 1 illustrates the use of two thermostats selected by a single-pole, double-throw switch, which controls the compressor motor-starter holding coil. During normal storage operation, the room temperature is controlled by the 40F thermostat while the 15F thermostat is used for the pulldown shock period.

At the end of the pulldown period, the circulating fans should be stopped to prevent a rise in humidity during the defrost period when the temperature builds up to 40F. Sprinkler systems should be drained during the pulldown period.

Wiring diagram, Fig. 2, illustrates the use of one thermostat set for maintaining the normal storage temperature of 40F. For the pulldown period, this thermostat may be short-circuited, permitting the condensing unit to operate continuously until stopped either manually or by the low pressure cutout.

In fur storage vault applications the refrigerant used should not be harmful to furs and other valuable articles stored therein. Direct expansion Freon-12 cooling units are usually installed in modern storages. These units may be floor or ceiling mounted and located inside or outside the vault.

In the average installation, the cooling units will automatically defrost making a means for mechanical defrosting unnecessary. However, there is a possibility that mechanical defrosting equipment may be required and the purchaser should be informed of this possibility even though it is not expected in a well constructed storage. This need, when it does occur, is considered abnormal. Excessive moisture infiltration is due to vault construction

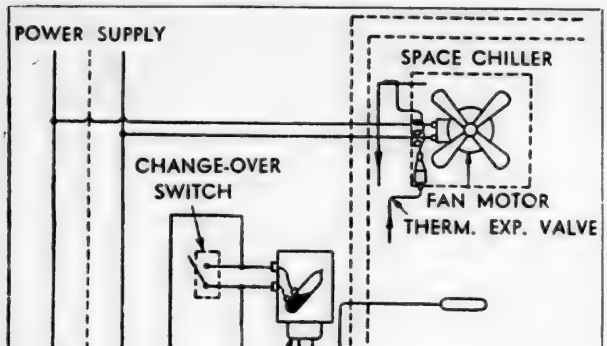


Fig. 2. Typical wiring diagram using only one thermostat.

or extreme atmospheric conditions during shock pulldown and may not become apparent until the installation is in operation. When such situations arise, the additional equipment may then be installed and should be considered as an extra necessitated by abnormal conditions.

Proper air circulation is important in all storage vaults so that the air passes over the top rows of garments. Two feet clearance will normally satisfy this requirement when using grilles or similar type outlets. Unit coolers when ceiling mounted may require as much as three feet clearance.

To comply with the Standards of the National Board of Fire Underwriters, reference is made to their pamphlet No. 81 wherein the Board specifies the following requirements for fur storage vaults:

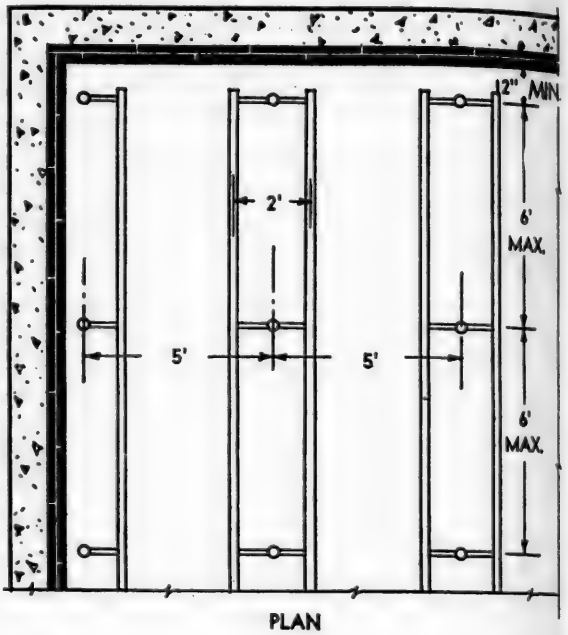
Walls, floor and roof construction. 8 inches of reinforced concrete, or 12 inches of brick, or 12 inches of plain concrete.

Door openings. Door openings shall be provided with approved vault doors of 4-hour or longer classification.

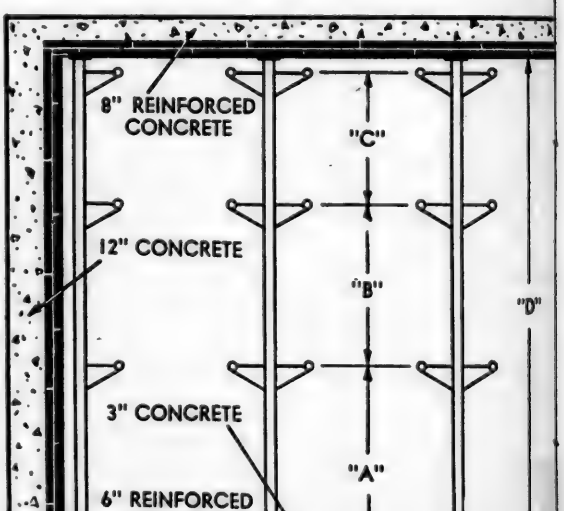
Water tightness. Walls, floor and roof shall be effectively water-proofed. Provision shall be made to prevent entrance of water at door openings.

Size limitations. Vaults exceeding 15,000 cu ft volume shall be subdivided by fire and smokeproof partitions of not less than 2-hour fire-resistive classification adequately reinforced for structural stability. Vaults exceeding 2,000 cu ft volume shall be protected by an approved system of automatic sprinklers or an approved automatic inert gas fire extinguishing system; also, an approved smoke detector system, or an approved smoke detector system and automatic fire alarm system.

Racks. Garments shall be stored in the vaults so as to make possible easy access to all parts of the vault for fire fighting or inspection purposes. Unbroken storage areas shall not exceed 24 ft in length and space for two coats or 5 ft in width. Aisles shall be at least 2 ft in width. Vertical clearances between the floor and the bottom row of garments, between the tops of the garments on a lower rack and the bottoms of the garments on a higher rack and above the top rack shall be at least 12 inches.



PLAN



ELEVATION

Typical Ceiling Section
8" Reinforced Concrete
Layer Asphalt
2" Cork
Layer Asphalt
2" Cork
Layer Asphalt
½" Metal Lath & Plaster or ⅛" Mastic

No. Tiers	Dimensions			
	A	B	C	D
1	5'-6"			7'-6"
2	5'-0"	4'-6"		10'-0"
3	4'-9"	4'-3"	3'-6"	13'-0"

Fig. 3. Typical rack layout and vault construction.

Vault contents shall be stored at least 12 inches below the level of sprinkler heads or alarm devices. Racks shall not be overcrowded and aisles shall be kept clear. (Usual practice is to allow one foot of rack space for each three to five garments. See Fig. 3 for typical rack layouts and dimensions.)

Design Problem

There are two general types of systems used in refrigerated vaults:

(1) Central plant with ductwork.
(2) Unit cooler inside the vault.

A design problem for type 2 will be considered.

A furrier in a large Eastern city bought a building for expanding his business as existing facilities were inadequate. The building consisted of six floors and a basement. The walls were 12-inch brick and the floors were reinforced concrete.

The customer desired to convert the entire third and fourth floors into refrigerated fur storage, using a small room in the southeast corner of each floor as an anteroom. The first and second floors were to be devoted to general offices and the processing and fumigation of furs. The fifth and sixth floors were to remain vacant until some later date.

The walls, floors and ceilings of the storage floors were to be insulated under a separate contract with 4 inches of corkboard or the equivalent. Cold storage doors were to be furnished by the insulation contractor for the openings leading from the anterooms into the vaults. Regulation vault doors were to be furnished by the customer for the anteroom entrances.

The two-tier rack arrangement was to be furnished by the customer.

Design Factors

The water supply being inadequate, the customer specified that an economizer be furnished.

Electric current characteristics were 220 volts, 3-phase, 60-cycle.

Water supply and electrical service were located in the basement.

Outside design conditions for this locality are 95F DB and 78F WB.

TABLE 2.—DESIGN CALCULATIONS

Item	Loads—Btu per 24 hrs	
	Shock, 15F	Storage, 40F
Walls, etc.		
10,224 × 115*	1,175,760	
10,224 × 79		807,700
Air change		
67,392 × 1.4 × 3.17†	300,000	
67,392 × 1.4 × 2.31		218,000
Product, etc.		
67,392 × 30/2	1,010,880	
Total	2,486,640	1,025,700
Tons refrigeration	8.6	3.6

*Wall heat leakage in Btu per sq ft per 24 hours. This is 115 for a temperature reduction of 80F, based on outside design conditions and for 5 inches of cork insulation.

†Heat removed in cooling air to storage conditions, in Btu per cu ft, based on ambient air conditions and storage temperature is 3.17.

The vaults were completely insulated with 4 inches of glass wool.

The customer desired that cutting, patching and painting be kept to a minimum making unit coolers inside the vaults the recommended equipment for this application.

There were no objections to installing compressors and economizer for each storage vault on that respective floor. Fig. 4 shows their location outside the vaults.

Analysis of Problem

The shock method of refrigeration was chosen by the customer as the most desirable treatment for his installation.

Each storage vault is divided into three rooms, each room separated by a brick fire wall having a metal clad sliding door. This vault layout further recommended the use of unit coolers located in each room.

The ceiling height inside the vaults permitted the installation of unit coolers so that the cold air discharged over the top rows of garments in accordance with good practice.

Load Calculations

As previously described, the two storage vaults are identical and superimposed on adjoining floors of the building so that the floor of the upper vault is over the ceiling of the lower vault. Therefore, no heat load is figured for the upper floor and the lower ceiling.

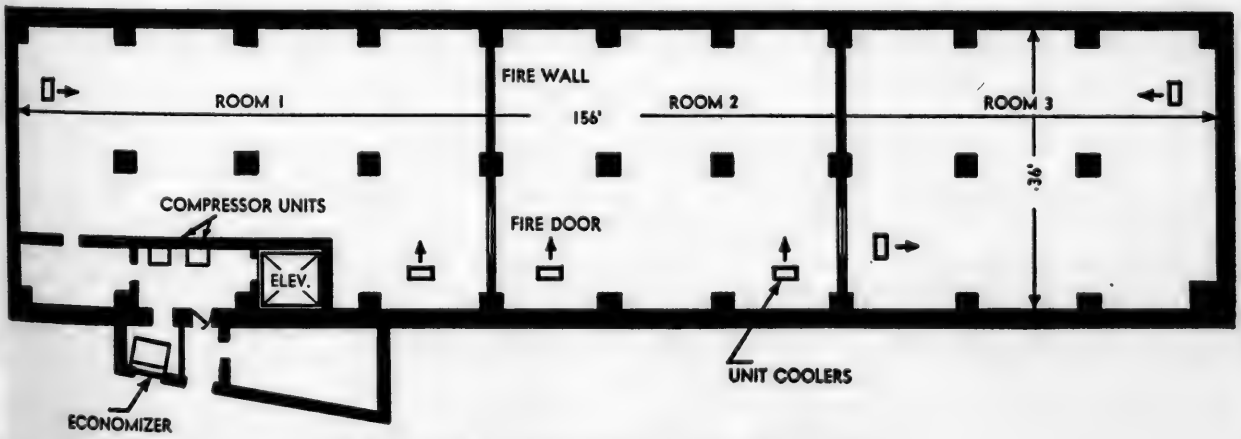


Fig. 4. Layout of vault considered in the design problem.

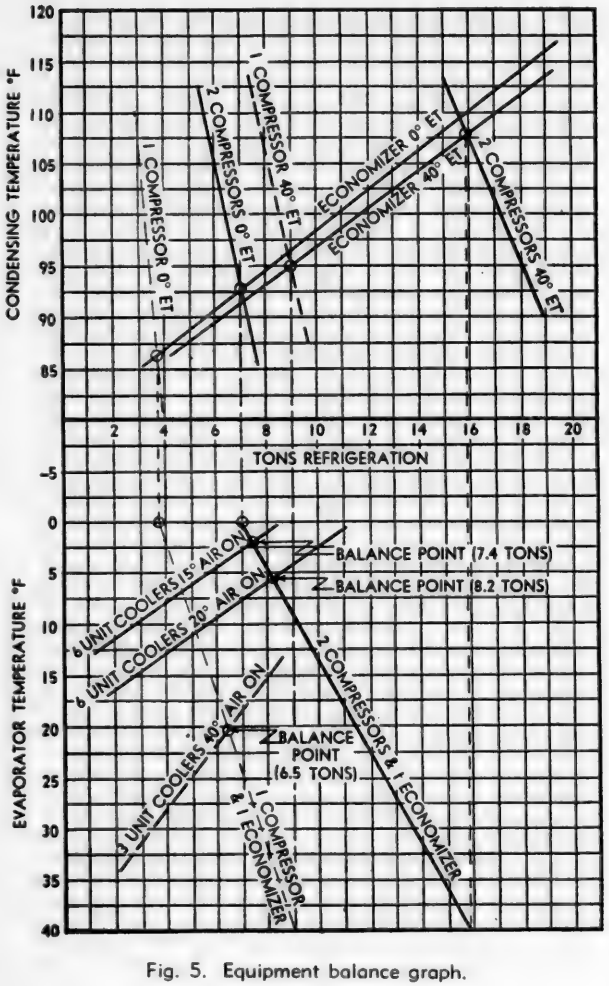

CONDENSING TEMPERATURE °F
EVAPORATOR TEMPERATURE °F
TONS REFRIGERATION
1 COMPRESSOR 0° ET
2 COMPRESSORS 0° ET
1 COMPRESSOR 40° ET
ECONOMIZER 0° ET
ECONOMIZER 40° ET
2 COMPRESSORS 40° ET
BALANCE POINT (7.4 TONS)
BALANCE POINT (8.2 TONS)
6 UNIT COOLERS 15° AIR ON
6 UNIT COOLERS 20° AIR ON
2 COMPRESSORS & 1 ECONOMIZER
3 UNIT COOLERS 40° AIR ON
BALANCE POINT (6.5 TONS)
3 UNIT COOLERS & 1 COMPRESSOR & 1 ECONOMIZER

Fig. 5. Equipment balance graph.

The calculations are shown for one vault and would be the same for the other.

Area (walls and floor or ceiling)	10,224 sq ft
Volume	67,392 cu ft

The values for wall losses are based on 5 inches of cork; the equivalent of 1-inch of cork is allowed for the thick walls. Heat leakage and air change was figured according to standard practice.

The load for product, lights and occupancy for the shock period was determined by using the value of 30 Btu per cu ft of volume. This value is applied over a period of 48 hours instead of 24, since the temperature would be reduced to 15F over week-ends.

No product load was figured for the holding period since none will exist except when garments are brought in, and this will be done in the spring when the ambient temperature is lower than design. Calculations are given in Table 2.

From the standpoint of equipment selection the storage load is unimportant since it is less than the shock load. However, equipment performance, at the storage temperature of 40F, can be checked to determine whether a portion of the refrigeration equipment, unit coolers and compressors, can be stopped during the storage period.

Equipment Selection

Unit coolers and condensing equipment were selected to satisfy the shock load on 24-hour operation. No time was allowed for defrosting since it was expected that frost accumulation would not require it at the low air temperature that would exist during the shock period.

The unit coolers, compressors and economizer were selected from capacity tables and their performance was analyzed graphically as shown in Fig. 5. It can be seen that the equipment selected balances at a capacity of 7.4 tons when the air in the room is 15F and at 8.2 tons when the air temperature is 20F. Thus it can be expected that the equipment will have capacity in excess of the calculated load during most of the pulldown period. For the last few degrees of pulldown the capacity is slightly under the calculated load, but during this time the cooling load will be less than the calculated value (which is an average).

Controls

It is evident from the equipment balance, Fig. 5, that three unit coolers have excess capacity to meet the requirements for the normal 40F storage condition. It is also apparent that one compressor will balance with three coolers at an evaporator temperature favorable to obtaining the required humidity conditions. For this reason, the liquid line was split or divided into two branches, in order to allow three units to be shut off during the normal storage period. The compressors were installed in parallel so that either one could be used with either group of unit coolers.

Each room was provided with two room thermostats, one set for 40F and the other for 15F. All the 40F thermostats were connected in parallel as well as the 15F thermostats. By means of a selector switch outside the refrigerated space, either battery of thermostats can be used to control compressor operation. Since the thermostats are wired in parallel, the compressors will continue to operate until the last room is down to temperature.

Chinchillas Breed in Air Conditioned Quarters

In breeding chinchillas in this country, it is necessary that air temperature be less than 70F and the relative humidity under 50 per cent. These conditions are best both for breeding rate and for quality of fur.

In a chinchilla ranch at Conley, Ga., which accommodates 84 pairs of animals, a U. S. Air Conditioning Corp. packaged unit maintains desired air conditions. This ranch is the nineteenth in a chain owned by Jerrica, Inc.

Chinchillas have from two to three litters a year. Each litter has two young.

All of the American chinchillas are descendants of eleven animals that were trapped in the Andes and brought to the United States in 1923. At present there are more than 450,000 chinchillas in this country owned by 8,000 breeders. Since each pair of these animals is valued as high as $2,000, it is evident that the breeders are interested in maintaining conditions that will promote the health of the chinchillas and assist in producing a quality fur. Proper air conditions result in more frequent breeding and in better appetites for the animals.

New Research Reported

Abstracts of the papers given at the technical sessions arranged for the sixtieth annual meeting of the American Society of Heating and Ventilating Engineers held at Houston, Tex.

FOUR technical sessions were held as part of the program arranged for the sixtieth annual meeting of The American Society of Heating and Ventilating Engineers held at the Rice Hotel, Houston, Tex., on January 25-27. Papers presented covered a wide range of subjects. The following abstracts of these papers, together with their findings, help one to obtain an overall picture of the technical information presented.

Hot Water Flow in Floor Panels

E. L. Sartain, research associate and W. S. Harris, research professor of mechanical engineering, University of Illinois, presented a paper on Heat Flow Characteristics of Hot Water Floor Panels. Heating panels in this test consisted of serpentine coils of ¾ inch black pipe laid on 12-inch centers in a 4-inch concrete floor slab. The paper was confined to findings regarding heat exchanges between the panel and surroundings, and the effectiveness of several methods of insulating the panel in reducing reverse losses. Three types of floor insulation were used. Rooms *A, B* and *C* were exposed only to the north.

Air temperatures at the center of the rooms were very uniform, with a variation between the floor and 60-inch level of 0.5 deg. Temperatures of the air 3 inches below the ceiling and 3 inches above the floor were practically the same.

The measured heat flow from panel to room ranged from 87 per cent of the calculated above floor heat loss in Room A to 101 per cent of the calculated above floor loss in Room C.

Fuel savings resulting from the use of insulation under the entire floor slab, as compared to the use of edge insulation only, was too small an amount to warrant the additional cost.

Vertical insulation along the inside edge of the foundation wall was as effective as the L-type edge insulation. Savings in material and ease of installation made the vertical insulation the more desirable of the two types.

At design conditions, the reverse loss from panels with edge insulation amounted to 20 to 23 per cent of the total panel output. The reverse loss was roughly twice as great as the estimated heat loss through unheated floor slabs.

While the main floor surface temperature was uniform across the panel, the heat emission rate was much higher near the exposed wall and window than at the center of the room. Thus, the floor panel system had the desirable characteristic of automatically increasing the heat output rate in areas adjacent to the points of high heat loss from the room. For a given floor surface temperature and room air temperature, one could expect a somewhat higher output per square foot of panel area in an uninsulated room or one with large glass area, than in a fully insulated room with limited glass area.

Factors Influencing Panel Heating Performance

Experiments were conducted in the Environmental Laboratory of ASHVE to study the effect of non-uniform surface temperature, floor coverings and room furnishings on panel heating. This was covered by L. F. Schutrum, research engineer, and C. M. Humphreys, acting director of research, both of the ASHVE Research Laboratory.

Tests were conducted with several ceiling temperatures, various configurations of wall and floor surface temperatures, and with various infiltration rates and temperatures. The space was fitted with furnishings and floor coverings to bring the tests near the actual goal of a furnished room. Conclusions arrived at follow:

The performance of a panel heating system in a space having a non-uniform surface temperature environment can be predicted with satisfactory accuracy on the basis of the area weighted average unheated surface temperature of the space.

Furnishings in a panel heated space tend to reduce the heat output of the panel, and increase the room air temperature. However, the net effect of these trends may be considered negligible for design purposes.

When a floor covering is laid over a heated floor panel, the surface temperature of that panel and the temperature of the heating medium must be considerably increased to maintain the same heat output to the space that would be obtained from the bare panel. For a heat output of 25 Btu per (hr) (sq ft), the amount of this temperature increase was found to vary from 27 to 60F for the various combinations of carpets and pads tested.

Coverings for heated floor panels should be selected to provide a minimum of resistance to heat flow from the panel to the space.

The person living in a floor panel heated room should select floor coverings having high thermal conductances. For instance, a rubber pad has much less effect on the operation of the heating system than a hair and jute pad.

Measuring Mean Radiant Temperature

In a paper on A Two-Sphere Radiometer, by D. J. Sutton, assistant to head of mechanical engineering department, University of Minnesota, and P. E. McNall, Jr., supervisor of general research, Minneapolis-Honeywell Regulator Co., were presented both theory and design details regarding a nondirectional radiometer which can be used to measure the effective mean radiant temperature in an environment having low temperature surfaces. The instrument described gives a reading which is indepen-

dent of air temperature and air velocity effects, and it measures the average mean radiant temperature over a five-minute interval.

To make an MRT measurement, the operator adjusts radiometer power inputs so that the sphere heaters cycle properly. Cycling is indicated by on-off operation of the green pilot bulbs on the control box. He then depresses the cycler starter button. The on-cycle is indicated by a white pilot bulb. For the next five minutes, the operator is free to perform other tasks. After this five-minute time interval, the cycler automatically turns off and the total on-time reading is retained on the timer. When the white pilot light goes out indicating completion of the cycle, the operator records the total on-time reading and the auxiliary input selector position. From this, the MRT can be obtained from a calibration chart. To start the next reading, the operator resets the timer to zero and depresses the starter button. The operator then goes through the cycle just described.

Considerable work has been done to develop radiometers which will be smaller in size and have faster response to environmental changes. These advancements will be made possible by improved construction and heater design techniques, and also the availability of small composite hermetic seal units. All of these factors will result in an improved instrument.

Cooling a Small Residence

A study was made of summer cooling last year in a research residence at the University of Illinois, using a perimeter loop duct system. Results of this investigation were reported by D. R. Bahnfleth, C. F. Chen, and H. T. Gilkey, all members of the mechanical engineering research staff at the University of Illinois, in a paper Cooling a Small Residence Using a Perimeter-Loop Duct System.

Objectives of the study were to determine the cooling load and its hourly variation when cooling the research residence under both day and night conditions; to determine time lags in heat flow through the walls and ceiling; and to compare the actual cooling load with the cooling load calculated according to a procedure in the Guide, 1952.

In general, the measured heat flow rates through walls exposed to direct solar radiation were higher than the calculated rates. The measured heat flow rates through walls not exposed to direct solar radiation were less than the calculated rates. The 22 per cent reduction in the sol-air temperatures for horizontal surfaces applied to the roof-attic-ceiling combination caused the measured heat flow rate to be greater than the calculated rate. The difference between the measured and calculated heat flow rates through the south wall decreased as the season progressed.

In all studies, the total calculated heat gain for the period 6 a.m. to midnight exceeded the total heat removed by the cooling unit during the same period by at least 57 per cent. When the blower operated continuously, the largest differences between the measured and calculated cooling loads occurred near the end of compressor operation. With the blower cycled with the compressor, the largest differences in measured and calculated cooling loads occurred at the beginning of compressor operation. The variance in times of occurrence of the large differences are attributed to the flywheel effect of the concrete slab floor.

During the test period which ran from June 24 to August 31, there was no visible evidence of condensation on the floor surface.

Floor surface temperatures in areas remote from the ducts and subfloor plenum were found to equal or exceed the room air temperature.

Circuit Analysis

H. B. Nottage formerly research associate and C. V. Parmelee, research associate, ASHVE Research Laboratory are the authors of a paper on Circuit Analysis Applied to Load Estimating. It is a progress report on the development of improved methods of estimating instantaneous air conditioning system loads for buildings which are subjected to variations in outdoor air temperature and intensity of solar and sky radiation.

The thermal circuit for the room was analyzed by a method well established in analyzing similar electrical networks. The paper presents the procedure and calculation details. Much remains to be done toward making the method easily usable in everyday work, but the principles of circuit analysis are well established.

Thermal circuit principles and methods of analysis have been demonstrated to yield practical results in the analysis of periodic heat transfer rates and temperatures in air conditioning systems.

The difference between the instantaneous rate of heat gain by the method in the Guide and the instantaneous system load by circuit analysis, is believed by the authors to demonstrate the practical value and economic savings which can be gained by designing according to circuit principles.

Pressure Loss of Air Through Wooden Louvers

P. R. Cobb, research assistant, Texas Engineering Experiment Station, College Station, Tex., prepared a paper on Pressure Loss of Air Flowing Through 45 Degree Wooden Louvers.

The principal variable affecting pressure in 45 deg wooden louvers with a free area ratio above 0.5, is the average velocity of the approach air. With this type of louver, the pressure loss varies as the square of the velocity.

The combined effect of the viscosity of the air and the hydraulic radius of the louver for 45 deg wooden louvers of this free air ratio were found to be negligible. This conclusion was reached after the dimensionless group, $P/\rho V^2$ was plotted as a constant for different values of the free area ratio. In this P is the pressure loss of air flowing through the louver, pounds mass per foot minute squared; ρ, density of air flowing, pounds mass per cubic foot; V average velocity of the air flowing through the inlet duct in feet per minute.

Also learned from this study was that as the free area ratio decreased, the combined effect of the viscosity and the hydraulic radius on the pressure drop increased, and that the pressure loss approaches a linear function of the velocity as the free area ratio decreases.

This study involved a large amount of test data and calculations, and a large table was included with the paper which summarized this work.

Cooling Tower Performance

In the paper, Prediction of Cooling Tower Performance, by Wesley W. Smith, associate research engineer, Texas Engineering Experiment Station, College Station, Tex., was presented a method to facilitate the approximate prediction of counterflow cooling tower performance under conditions of variable water rate, air rate, wet bulb temperature, cooling range, approach to wet bulb temperature and elevation above sea level. A number of graphs were developed to simplify the solution of problems.

Air Conditioning and Plant Growth

F. W. Went, professor of plant physiology, California Institute of Technology, reported on Effects of Air Conditioning on Plant Growth.

While considerable work has been done in developing plants of high productivity and disease resistance, soil treatment, and efficient farm machinery nothing is done about the weather or conditions under which the plants have to grow.

A study was made to determine the effects of relative humidity, wind velocity, light intensity and temperature in greenhouses and conclusions drawn regarding a means of increasing production of food through proper air conditions.

A study was made of the tomato plant. Relative humidity of 25 per cent had the same effect as a reading of 80 per cent, when the plants have developed a large root system and are watered regularly.

Plants grown at wind velocities of 250 fpm and low light intensity are sturdier than plants grown in relatively calm air at the same light intensity. Light intensity is of great importance in the growth of the tomato plant. Greenhouse temperatures should be kept lower on dark days because at low temperatures, leaves are light-saturated at a lower light intensity.

Air conditioned greenhouses are essential for the investigation of plant behavior in relation to their environment. The most important factors which have to be considered in the construction of air conditioned greenhouses are discussed in this paper.

Heat Pump Operating Costs

J. Donald Kroeker, consulting engineer, Portland, Ore., and Ray C. Chewning, affiliated with that office, presented a paper on Costs of Operating the Heat Pump in the Equitable Building. Although papers were presented on two previous occasions on this installation, this paper reports on operating conditions for one calendar year.

Some interesting observations were made regarding one year's operation such as:

Heating, as a byproduct of cooling, represented 37 per cent of the total heating provided.

The cost of energy for the year per square foot of net rentable area totalled 0.52 cents for heating and 3.85 cents for cooling.

The total cost of operating the system for the year totalled 2.1 cents per square foot of rentable area for heating and 9.2 cents for cooling, or a total of 11.3 cents.

The authors pointed out that while in the study of operation costs of the Equitable Building, it was found that a heat pump might not be economical when installed for the purpose of heating alone, its use in conjunction with cooling can result in an appreciable saving as compared to a conventional heating and cooling system in a building as large.

Since the heat pump finds economic application as the means of heating only when conditions are favorable and a cooling system is desired, the determination of heating cost should be made on the basis of a system performing a comparable function. Demands should be computed and a method of making an analysis is described.

Both heating and cooling are produced from the energy required for cooling alone, and it is necessary to consider the quantity of heat that is produced as a byproduct.

The greater the emphasis placed upon demand charges in the electrical rate under which the heat pump must operate, the more economical will be the heating with a heat pump in an air conditioning system. In any large heat pump installation, the permanent installation of recording demand meters will probably be economically justifiable as an aid to the operating engineer in avoiding demand peaks chargeable to heating.

Solar Energy Available for Heating

As the result of research sponsored by ASHVE in cooperation with the Department of Mechanical Engineering, University of Minnesota, a paper was prepared on Solar Energy Availability for Heating in the United States, by Dr. R. C. Jordan, head of the Department of Mechanical Engineering and J. L. Threlkeld, associate professor, University of Minnesota.

Included in this paper are data on the distribution of solar radiation available in the United States on variously oriented surfaces for cases outside the atmosphere, at the earth's surface during cloudless days, and at the earth's surface during all days.

The superiority of a south-facing surface for interception of winter sunshine is shown and there are maps to show the estimated average daily radiation incident upon a south-facing vertical surface for December and January.

Also included are results of analysis of U. S. Weather Bureau records for Blue Hill, Mass., Madison, Wis., Lincoln, Neb., Nashville, Tenn., and New Orleans, La., stations.

Room Air Distribution

A study of three floor locations for room air distribution for residential year-round air condition was made at the University of Illinois as a cooperative project between the American Gas Association and the Engineering Experiment Station of the university. Results of this study were reported by H. E. Straub, research associate in mechanical engineering, and S. F. Gilman, research assistant professor of mechanical engineering at the university in a paper titled Room Air Distribution Research for Year 'Round Air Conditioning.

With several sizes of floor registers and floor diffusers installed singly at one of three locations in a test room, studies of the room air distribution were made over a range of flow rates under winter heating, isothermal and summer cooling conditions of operation. It was found that floor outlets located at the center of an exposed wall

provided the best air distribution during such operation.

The extensive tests that were conducted showed that during year-round conditions of operation, better air distribution was obtained with floor outlets than with high sidewall outlets.

When floor diffusers were used, they produced a more uniform air motion and a lower temperature variation during heating than floor registers. Diffusers were especially effective in the unrestricted location near the center of the exposed wall.

With floor outlets and winter heating conditions of operation, an increase in supply air velocity produced only a slight improvement in the air distribution. However, an increase in flow rate, with a subsequent lower supply air temperature, resulted in a significant improvement. With a high sidewall outlet, either an increase in the supply air velocity or the flow rate produced a significant improvement.

The best air distribution during cooling was obtained with outlets located near the center of the exposed wall. Under these conditions, good air distribution was obtained with a temperature differential as large as 20F.

In order to obtain optimum air distribution during cooling, a higher supply air velocity was required with floor diffusers than with floor registers.

For the simulated crawl space conditions, the floor surface temperature was much lower and the temperature variation somewhat higher than those obtained under comparable heated basement conditions.

Storm sash installed on the windows obtained only slight improvement in the air distribution.

A floor outlet located at the center of an exposed wall has excellent possibilities of providing good air distribution during year-round air conditionng, particularly if the flow rate used during summer cooling is also used during winter heating.

Floor Panel Control Systems

Recommended practices in both the operation and type of floor panel control systems were covered in Field Studies of Floor Panel Control Systems. The paper was prepared by A. B. Algren, professor, department of mechanical engineering, University of Minnesota, E. F. Snyder, Jr., supervisor, Products Application Commercial Division, Minneapolis-Honeywell Regulator Company, and R. R. Head, assistant professor, University of Minnesota. Results of two years of field studies, together with complete construction and instrumentation details were presented in a previous paper.

Field studies were conducted on control systems in three basic types of construction:

(1) Heavy floor panel, heavy building construction, and large glass area. Installation was a single story general office in a Milwaukee factory building.

(2) Heavy floor panel, light building construction, large glass area. This installation was in the factory section of a Milwaukee factory.

(3) Heavy floor panel, light building construction, small glass area — a Milwaukee residence.

Factors important in the control of floor panel heating systems were studied including: Rapid changes of heating load; thermal inertia of floor panel slab; use of solar compensator; location of outdoor temperature sensing bulb; common return water headers; thermal inertia of solar compensator; boiler water temperature control, both the fixed and reset types; constant versus variable heating load; exposed walls and the effects on control, temperature distribution, and air motion; floor covering.

It is believed that various design improvements are dictated from the results of the installations thus far studied and that to warrant further studies, it would be necessary to have an installation in a controlled environment.

Solar Energy for House Heating

A rational method for calculating daily collector efficiency, and also curves for efficiency, are part of a paper on Utilization of Solar Energy for House Heating, by J. L. Threlkeld, associate professor and R. C. Jordan, professor and head, department of mechanical engineering, University of Minneapolis.

The authors reviewed the work of early investigators, the studies of Lof and results at the Dover, Mass., house and experimental houses at MIT.

To collect solar energy for house heating in an efficient manner, it is desirable to keep the temperature of the collector plate at a relatively low level. For such application, the flat plate type of collector with one or more separated sheets of glass, is the most common. The best orientation for such a collector is a south-facing wall.

If solar energy is to contribute an appreciable part of the heating requirements for a building, energy must be stored during sunny periods for use at night and during cloudy days. An ideal heat storage system includes at least the following features:

(1) Low cost and ready availability of storage medium.

(2) Non-hazardous, non-offensive materials.

(3) A storage medium which is non-corrosive to common construction materials.

(4) A simple, inexpensive means of packaging the storage medium.

(5) High heat capacity per unit volume of storage medium.

(6) Low thermal losses from storage medium to ambient surroundings.

The use of refrigerating equipment for winter heating and summer cooling has sponsored greater interest in the heat pump. In connection with the heat pump, the use of solar energy as the heat source offers distinct advantages of a higher temperature heat source than the presently available sources such as air, ground water, and the earth.

F. Paul Anderson Award

At this convention, the society presented the F. Paul Anderson Medal to Walter L. Fleisher of New York City in recognition for outstanding contributions to the advancement of heating, ventilating and air conditioing in the field of human comfort. In addition he served as head of a number of important committees and is a past president of the society.

During the convention, one afternoon was set aside for inspection trips to a number of public, industrial and business buildings including the city's new medical center where it is possible for the visitor to see several types of heating and air conditioning installations, Hughes Tool Company; Gulf Brewing Company; Sugarland Industries, Sugarland, Tex.; Schlumberger Well Surveying Corp.

LONDON LETTER

Commentary on developments in Europe by our correspondent in Great Britain

AFTER a spell of severe cold which has found its way into many British homes the London correspondent of a Swedish newspaper has written to *The Times*. He implies that it will probably take another hundred years or so for these British Isles to be invaded and occupied by the American, Western European and Scandinavian realization that it is by no means necessary to have winter indoors. To prevent frozen tanks and pipes in the meantime he suggests that the English, with their unconquerable spirit and genius for compromise, should invent some kind of drinkable anti-freeze for use in the water systems of houses.

Perhaps he has not visited the more northerly parts of the island, inhabited by the Scots. They invented the drinkable anti-freeze or unconquerable spirit many years ago, but they do not put it into the water systems of houses. They export it to America.

Heat Output of Radiators and New Heat-Exchangers

Central heating is clearly the foremost topic of the moment. This is the sort of weather which, to quote an earlier *London Letter*, is tolerated in Britain in preference to freezing. Perfect strangers working in the same office may even, without introduction, exchange remarks about the weather and then go on to discuss the (inadequate) output of radiators. There are, of course, various ways in which the heating engineer can measure this. In a paper contributed recently to a Swiss journal [Heizung und Lüftung (Schweiz. Blatt. für), **49**, *1* (25, Stadelhoferstr., Zurich)] P. Schlapfer argues the merits of the cooling method.

In the flow method, the temperatures of the water entering and leaving the radiator are measured, also the ambient temperature and the water flow. The water flow is difficult to measure accurately and the results are directly dependent on it. In the electrical method there is no attempt to measure the water flow, but the water is heated electrically and the heat input read off the electrical instruments. To obtain the heat transfer coefficient in either case, the heat loss in Btu per hour is divided by the surface area of the radiator in square feet and by the difference in degrees F. between the ambient temperature and the mean water temperature. The calculation is simplicity itself, but the measurements are not easy. In the cooling method the radiator is filled with hot water and allowed to cool down, the water temperature being measured at intervals to give a cooling curve. From this the rate of heat loss at any temperature difference above ambient can be deduced and the heat-transfer coefficient then calculated.

The more complicated mathematics are more than outweighed by the simpler experimental technique and the author reports on 25 patterns of radiators using different heights, numbers of sections and surface finishes. He found that smooth surfaces are significantly better than rough surfaces and that red or green paint improves heat output.

A new idea in radiators that are to be operated on a district heating system is reported from Berlin by W. Zimmermann (Heizung und Lüftung, **52**, *4*). A serious problem in the Berlin district heating system was corrosion, attributable largely to entrance of oxygen at the consumer's premises. The solution chiefly used before the last war was to pass the consumer's condensate through manganese-iron wool before allowing it into the condensate return line. It is now proposed to use a completely closed system, but instead of one heat-exchanger for each house there will be a small cartridge-type heat-exchanger for each radiator. Ordinary low-pressure radiators can be used without modification. The heat-exchange cartridge is inserted horizontally into the bottom of each radiator and is extremely circular or (better) star-shaped in section. Internally it is divided by means of a longitudinal diaphragm into flow and return halves. High-pressure steam or hot-water pipes must run through the building to each radiator, but the cost is said to be only 60% of that of putting a single heat-exchanger in the basement and distributing the heat to the different rooms in water at atmospheric pressure.

When Is a Boiler Not a Boiler?

The increasing popularity of high-pressure hot-water systems in Europe has posed some legal questions and A. Missenard put them up for discussion among the heating and ventilating engineers of France [Chauffage, Ventilation, Conditionnement, **51**, 5, 10 (19, Rue Blanche, Paris IX)]. Two principal questions are: to what extent do the existing regulations apply to high pressure hot water systems; and what further legislation is desirable? Some rules are desirable both so that the user of a system involving high pressure and high temperature is safeguarded against risk, and so that there will be less likelihood of unforeseen accidents which could bring the system into disrepute.

The existing rules for steam apparatus are sometimes applicable and sometimes ludicrous. For example, the type of boiler for HPHW systems which maintains pressure in the system by generating a steam pressure in the space above the water is practically a steam boiler and can be equipped with a water level gage in the usual way; but is the return pipe a feed pipe? If it is, it should have a non-return valve in it. But the boiler can be emptied just as easily through the outlet pipe if damage occurs in the circuit, so there isn't much point in

the non-return valve. When this was explained to the Ministry the officials asked that the outlet pipe should be fitted with a valve that would close if water passed through the pipe at an excessive speed. But engineers in the industry took the view that the closing of such a valve to stop the water flow at high speed might itself cause damage to the installation. It was finally agreed to make the rule that both flow and return pipes should end only a little way below the normal water level so that only partial emptying of the boiler could take place.

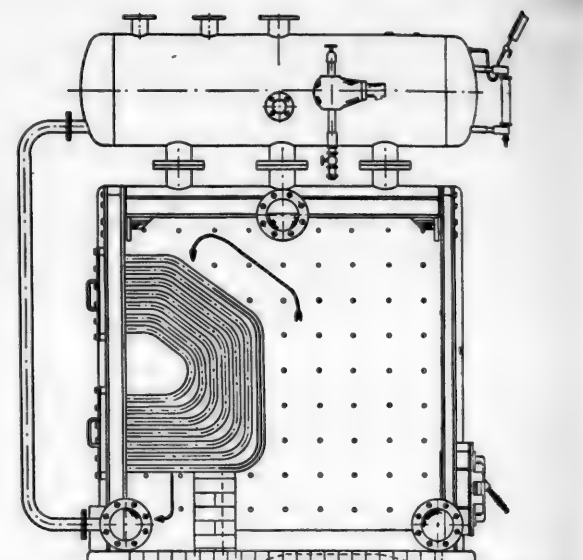
But with the type of "boiler" that consists of nothing more than a bundle of tubes with an expansion reservoir in a different building some distance from the boiler house, where does one put the "water-level gage-glass visible to the boiler operator?" For some regulations it is necessary to decide whether the expansion reservoir is part of the "boiler" or if it is a "steam receiver." One can hardly call it the latter, but in order to classify the boiler correctly the relation between boiler volume and boiler heating surface is required. If the expansion reservoir is part of the boiler, which boiler is it part of when several boilers are in a system with one reservoir?

Switzerland and Germany had more complete codes, said the author, and these could be drawn upon in devising new regulations for France. But Mr. Prud'hon, in the discussion, wanted no new regulations until the technique had been further developed. There were many problems, some quite unexpected, which called for technical and not legal solutions. For example, if at any time the pressure anywhere in the system falls below design pressure, boiling or flashing may occur. A drop of only a few degrees in the temperature in the expansion reservoir may reduce the system pressure sufficiently to cause the boiling of water already on its way round. The suction side of the circulating pump is a position that calls for particular care. The design must also allow for the increase in volume of the water as it is heated up from cold, and if corrosion is to be avoided greater attention must be paid to acidity and oxygen content than has been the custom. Let improved technique precede new regulations.

Some New Types of Boilers in Europe

It is only recently that coal and steel supplies in Britain have been short. It is not so long ago that the steelworks of this country supplied the materials and structures for building the steelworks and coke ovens of the U. S. A. In those days the Lancashire boiler reached a stage of development which made it the standard steam-raising unit for all factory purposes. It should not be difficult to find still in service Lancashire boilers about a century old. The Economic boiler, only about half the length of shell and with small smoke tubes to increase the heating surface, is the only major development. Either type has a reasonable efficiency that can reach 75 or even 80%, but which under average firing conditions is more likely to be 50 or 60%. For low-pressure hot-water heating the sectional boiler with efficient radiant heating surface but practically no convection heating surface is the standard appliance.

On the continent the less abundant supplies of coal and steel have stimulated the search for improved designs. One new idea being developed in Switzerland for steam-raising up to about 200 psi has been described by the inventor H. E. Witz [Brennstoff, Warme, Kraft, **5**, *1*, 19 (77/79 Prinz-Georg-Str., Düsseldorf)]. It was first described about four years ago, and the most recent report shows a few changes in the water circulation system.



Sectional view of the Bouellat Boiler reproduced from the Industrial Heating Engineer.

Externally the boiler is a smooth vertical cylinder. The upper half consists of the steam and water drum surrounded by the annular economizer. The lower half consists of the furnace chamber surrounded by the annular steam-generating section. In the early design, tubes led water from the economiser to the bottom of the steam-generating section, but this appears to have been found unnecessary. The annular surround to the furnace is now simply a waterjacket which serves as a downcomer to supply the steam-generating tubes. These tubes are connected at their lower ends to this water-jacket and at their upper ends into the bottom of the drum, passing through the combustion space. The combustion gases find their way between these steam-generating tubes, between the drum and the economiser which surrounds it, and then down and up through smoke tubes in U form in the economiser. Feed-water is pumped through the economiser and sprayed through nozzles in the steam space in the drum. Efficiencies on test of the order of 90% on oil-firing have been obtained. Tests have also been made with coal, but the small passages get blocked with ash. The optimum size range for this design is 4000 to 8000 lb per hr.

A design of boiler to cope with all types of fuel for space-heating purposes is the Bouëllat boiler (illustrated). This can be used for hot water or steam up to a maximum pressure of 100 psi. The range is 600,000 to 5½ million Btu per hr. The construction is very simple. In essence it is a box, nearly 7 ft cube, enclosing a very large combustion space inside water-cooled sides, top, front and back. Each of these five sections is a welded unit with flat sides of mild steel plate, suitably stayed internally.

(*Concluded on page* 165)

Automobile Air Conditioning and Its Problems

Special problems must be overcome to provide suitable air conditioning for automobiles. This was covered by P. J. Kent, executive engineer, Electrical Section, Chrysler Corp., in a paper before the sixtieth annual ASHVE meeting. A condensation of that paper is presented.

AIR conditioning for automobiles has long fascinated the imagination of the automotive designer. What is not generally known is that between 1949 and 1953 about 10,500 automobiles were air conditioned by systems not produced by the automobile manufacturers. This picture changed, however, during 1953, and some of the major companies did design and build systems for use in their own cars.

Air conditioning for automobiles proved to be so popular during the past year that none of the companies were able to meet the demand for this innovation. Companies that produced air conditioned automobiles the past year are planning to increase such production for 1954. People who have to do a great deal of summer driving in the warm sections of this country realize the value of this improvement in their automobile and are either willing to pay the additional cost to obtain air conditioning or are willing to do without some of the other car extras available.

An estimate has been made that within the next five or ten years, about ten per cent of all new automobiles will be equipped with air conditioning. As the market expands, there will also be a change in mass production methods. There may even be a substitution of plastic parts for the more expensive metal stampings.

Design Features

The first rule that can be established is that an air conditioning system for an automobile should have sufficient refrigeration capacity to (1) lower the inside car temperature quickly, after it has been standing in the direct sun for some time and has picked up considerable heat, and (2) to quickly cool the car during a short ride.

During the period of idling an engine (studies show that the operator of an air conditioned car will idle the engine of an air conditioned car longer than for the other type) with the engine turning over at low speed, it is important that the power output be sufficient to operate properly the air conditioning system. For the designer, there has been new problems concerning engine cooling and compressor drive.

One of the selling points for this type air conditioning is the possibility of keeping windows closed to shut out street and highway noises. The sound level inside the car is most important. Therefore noise due to several high speed air jets used to distribute air, and that due to engine operation must be held down.

Outside air must be brought in to get rid of smoke and odors in the car and also to build up a slight positive pressure to keep down the infiltration of dust and large amounts of warm outside air. General practice is to use from 15 to 25 per cent outside air and to recirculate the balance. Cool air must be well distributed and should not strike the passengers.

The designer knows that planning an air conditioning system for an automobile is not as simple as it appears. When the condenser for the air conditioning system was placed in front of the car radiator, it added to the problem of engine cooling and some resorted to heavy duty radiators for satisfactory service. However, it was found that the standard radiator did best under idling conditions. For this reason and also because a more efficient

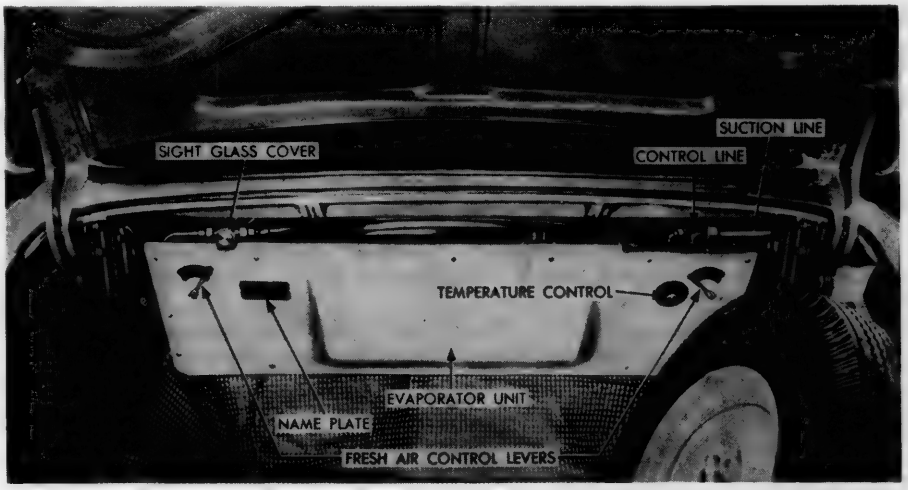


Fig. 1. View inside the trunk compartment of a Chrysler showing the fresh air control levers and other parts of the air conditioning system.

Fig. 2. Air grilles on the rear shelf of the car.

fan has been developed, the standard low restriction radiator is used.

Although there is a tendency to provide a large number of controls for the driver of an automobile, and theoretically the best operation of an air conditioning system would be to permit each passenger to adjust conditions to best suit himself, it is now believed that better general comfort and fewer problems will result if the individual driver has only a few simple controls. A properly conditioned car should have uniform temperature control with a minimum amount of draft.

Packaged Units

Some attention has been directed to the packaged unit as a means for solving some of the existing design problems. The unit should be designed to fit in the trunk space of the car and it should not interfere with the cooling of the engine. Since the unit will be assembled and tested at the factory, then once assembled and installed, it should be relatively free of refrigeration troubles. While a packaged unit will relieve the congestion in the engine compartment of the automobile, it takes away a large amount of the trunk space. The unit will have to be designed to clear some of the obstructions found in the trunk, such as the bump over the rear axle, and therefore, it will not be easy to transfer a unit from one car to a different model. Also with this added machinery in the trunk, it will be difficult to prevent some of the noise from entering the car.

If an electric drive is to be used for the packaged unit, a larger generator is required. If an auxiliary gas engine is used, here again there is an added noise problem.

At first, use of a packaged air conditioning system may be looked upon as a means for cutting costs; in practice, it has not worked out that way.

Whether the designer will follow present practice or lean towards the packaged unit is not known. However, it is known that some changes will have to be made in the present general system.

It will be necessary to develop a small, lightweight, durable compressor to stand up under high speed operation and also to show good performance at low speeds. Such a compressor would be less subject to vibration and it would provide better engine balance. A small unit is important for there is very little space under the hood for the present size compressors.

A variable speed drive would be desirable for all the engine-driven accessories such as water pump. fan, generator, pump for hydraulic steering, and the compressor. It would be better to obtain improved performance from these accessories at low engine speeds by driving them at higher speeds.

The design of the automobile will have to be altered to provide better means for cooling the condenser. It is important that compressor cooling should not interfere with engine cooling, and one of the means for obtaining this goal may be to install a separate fan or blower system so that cooling will be independent of the engine fan.

Automobile air conditioning has caught the public's fancy, and increased sales should encourage an improved and more serviceable design which will be lower in cost than the present system.

Parallel Operation of Reciprocating Compressors

According to Lincoln Scafe, manager, Service Department, The Trane Company, LaCrosse, Wis., two or more reciprocating compressors can be operated successfully in parallel in one refrigeration system, even though some designers shy away from such practice.

While there may be certain secondary factors involved, the principal reasons for the avoidance of the practice are:

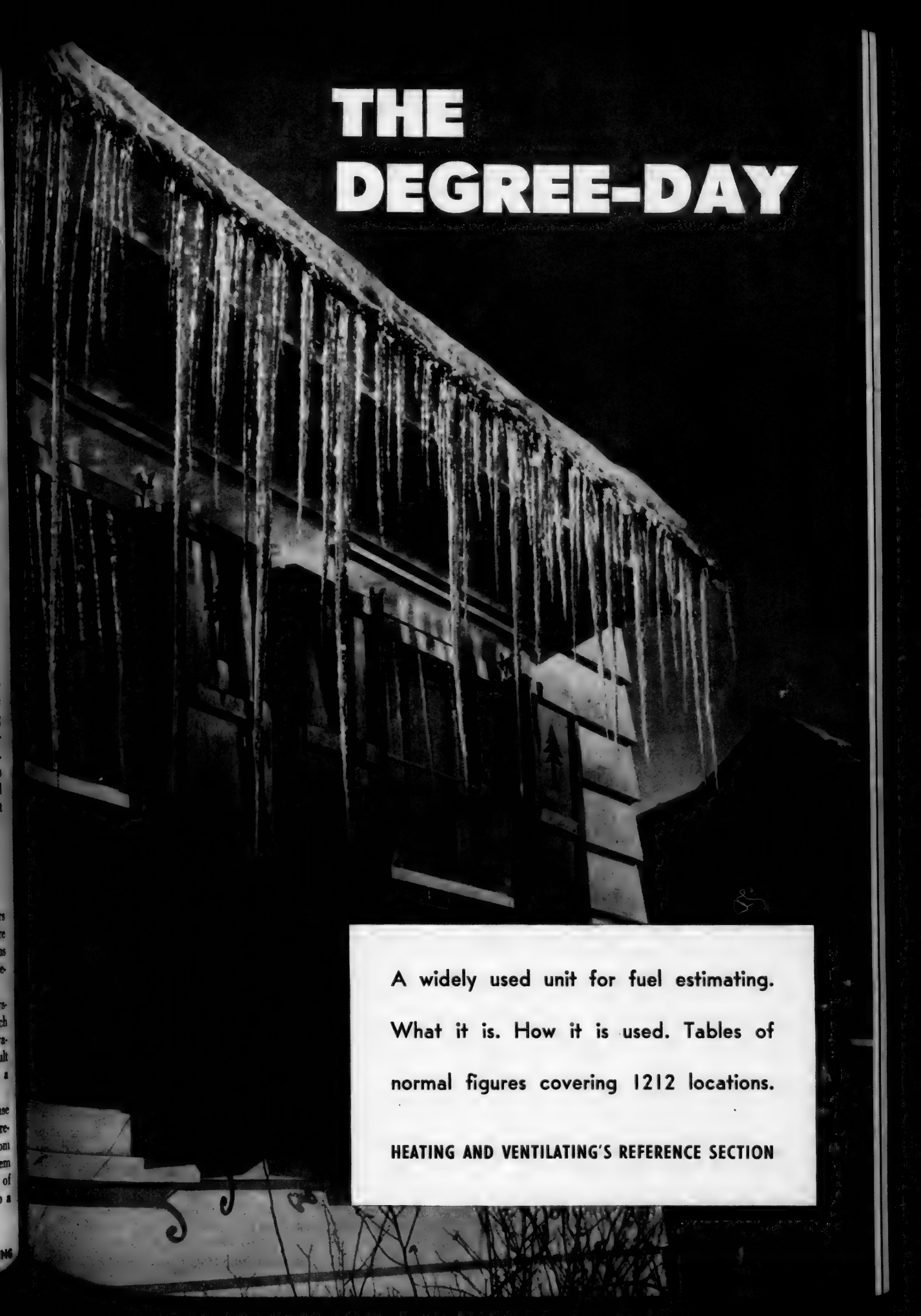
(1) The inability to maintain proper lubrication in all the machines involved.

(2) Lack of knowledge in proper procedures for successful refrigeration piping.

In a successful installation, according to information in Trane Weather Magic, each compressor operating in parallel must have the same proper lubrication as required for a compressor operating singly. To accomplish this, it is absolutely necessary to equalize crankcase pressures in the machines. Too often, in the past, improper equalizing devices have caused one of the compressors to lose its oil charge because the crankcase pressures were not equalized. This, of course, has resulted in serious damage to the machine and a resulting hesitancy in designing such systems.

It is also important that the lubricating oil in the system return uniformly through the suction line to each machine. Due to lack of knowledge in proper refrigeration piping, the oil has returned unevenly. The result has been compressor damage and a reluctance to use a system where the opportunity for damage is great.

However, it is entirely possible to equalize crankcase pressure of each compressor. Improved know-how of refrigeration piping makes it possible to return oil from suction lines evenly to each compressor in the system under all conditions of operation. Although the risk of damage is still there, good practice can reduce this to a decided minimum.



THE DEGREE-DAY

A widely used unit for fuel estimating. What it is. How it is used. Tables of normal figures covering 1212 locations.

HEATING AND VENTILATING'S REFERENCE SECTION

The Degree-Day — A Fuel Estimating Unit

CLIFFORD STROCK

EDITOR, HEATING AND VENTILATING

EXPERIENCE has shown that, for buildings requiring approximately 70°, the amount of fuel or heat used per day is proportional to the number of degrees the average outside temperature falls below about 65°. The degree-day is based upon this principle. Thus the *number of degree-days (65° F base) per day is the difference between 65° and the daily mean temperature when the latter is less than 65°.*

The number of degree-days *for a given day* is thus equal to (65° — daily mean temperature for that day) × 1 (day), and the number of degree-days *for any longer period* is the sum of all such products for as many days as the period covers.

For example, the highest temperature recorded in Baltimore on December 12, 1931, was 70° and the minimum was 52°. The daily mean temperature was therefore

$$\frac{70 + 52}{2}$$

or 61°. The number of degree-days for that day in Baltimore was thus (65 — 61) × 1 = 4. Carrying through this operation for each of the 31 days for December, 1931, it is found that the number of degree-days in Baltimore for that month is 601.

The degree-day thus defined is now so widely used that when the unit is mentioned in the U. S. it is understood that the 65° base is referred to unless some other base or some other descriptive word is used with it.

As early as 1915, Eugene D. Milener, then an engineer with the gas utility company at Baltimore, found that the gas consumption of house-heating plants in that city varied with the number of degrees difference in outside temperature and 64°. Later studies indicated that when the figure was 65° the relationship was improved. As a result the 65° figure was put into use and the name of degree-day was given to the unit related to this base temperature. Thus from its beginning the unit field study support for the conclusion that the proportionality between fuel consumption and temperature difference begins at 65° in residential gas heating.

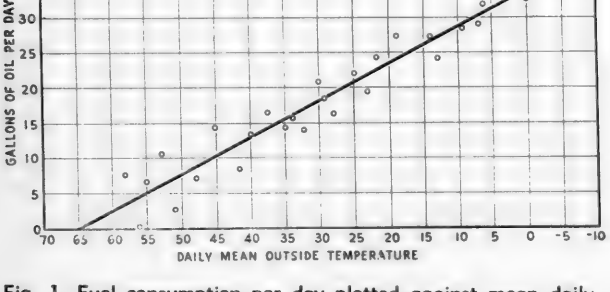


Fig. 1. Fuel consumption per day plotted against mean daily temperature. The curve best fitting the points shows a zero fuel consumption at 65°.

65° As the Base

Perhaps the earliest attempt to gather field data to confirm or reject the validity of the 65° value of the inside daily temperature took the form of noting in the field if there was any relation between the outside temperature and the time of starting up residential heating plants in the fall. It was found that when the mean daily outside temperature fell to about 65°, there was a considerable tendency to start the heating plant. Such observations tended to confirm the general idea that the base of proportionality was in the vicinity of 65°.

The general method of investigating the proportionality by direct field studies is illustrated in Fig. 1 where observed fuel consumption figures are plotted against daily mean outside temperature. In order to make such a study the fuel should be one that is easily measured, so that the exact quantity burned can be recorded without too much work, and the plant should be one in which the fuel measured is all used for the heating of the building and none for cooking or service water heating. In the example shown in Fig. 1, on a day when the mean temperature outside was 35° the plant required 14½ gallons of oil; when it was 40°, 13½ gallons; 0°, 32¼ gallons, etc. These points were plotted and a straight line drawn through them so that the points on either side of the line numbered about the same. In this case the line crosses the zero fuel consumption axis at 65°. In any particular plant, the straight line will cross at or a few degrees above or below 65°. If the variation is more than a few degrees some special conditions apply which must be taken into consideration. The point at which the axis is crossed fixes the value of the outside temperature at which fuel consumption starts, or the base of the proportionality between fuel consumption and temperature difference. Evidently, if a large number of separate plant operations could be studied the results would show whether or not the base line was generally at 65° or whether it was only accidental. Many such studies have now been made.

It might be supposed that, since the relationship of heat required and temperature was determined from an analysis of the performance of the heating plants in residences, a base temperature of other than 65° would apply to buildings with a different character of occupancy—such as office buildings and stores. When the inside temperature maintained is sharply different from 65°, as in certain industrial buildings, such a conclusion is correct. But buildings heated to 70° or about 70° show a relationship to the 65° base, even though their usage and character of occupancy may differ from that of the ordinary residence. A study made by the National District Heating Association of a number of buildings showed that the heat requirements of the buildings

reached zero at the bases listed in Table 1. It will be noted that in most cases the base temperature indicated by these studies is at or near 65°.

TABLE 1—BASE TEMPERATURE FOR DIFFERENT BUILDINGS AS DETERMINED BY FIELD TESTS

Type of Building	Base Deg.	Type of Building	Base Deg.
Offices	66.2	Apartments	68.8
Offices and banks	65.8	Residences	66.9
Banks	66.2	Clubs	65.5
Telephone exchanges	65.5	Theaters	67.6
Offices and stores	67.4	Warehouses and lofts	65.2
Stores	64.0	Manufacturing	65.4
Department stores	64.3	Average for 175 buildings of all types	66.0
Hotels	66.5		

While most types of building are operated with temperatures approximating 70° during the heating season, there are important cases where the maintained temperature departs considerably from 70°. Prominent among such cases are industrial buildings of various kinds.

In general, but little authentic information is in existence to show at what temperature the proportionality between fuel and temperature difference begins in such plants.

One point is especially noteworthy in connection with making use of degree-days where the maintained inside temperature departs considerably from 70°. In such a case unless the base temperature is changed accordingly very great errors may result.

The daily mean temperature is determined by averaging the maximum and minimum temperatures as observed for any day. The result is what is known as the daily mean temperature for the day.

An opinion sometimes expressed is that the degree-day is inaccurate because the wind is not taken into account. This is not altogether true. The effect of wind on the heating of a building depends on (1) the velocity and (2) the temperature of the wind. Both are considered for maximum conditions in the design of the heating plant and reflected in its size. The degree-day in turn, by indicating the temperature of the wind, takes care of this variable through the heating season. Not accounted for is the fluctuation of wind velocity through the season. Use of the degree-day implies that the effect of the wind varies inversely as its temperature and that the velocity varies with degree-days. The former is true, the latter true at times, not true at others.

Uses of the Degree-Day

There are two principal uses of the degree-day: (1) as a means of eliminating the outside temperature variable in comparing fuel consumption data, and (2) for predicting fuel consumption. The first use is one with wide application for keeping track of data for the same building. If a building used a given amount of fuel for a certain period during which there was a known number of degree-days, simple division gives the amount used per degree-day. If, in a subsequent period, the unit figure has sharply increased, then some reason must be looked for as accountable for the indicated drop in operating efficiency.

The Degree-Day as a Guide in Operation

The degree-day has been found increasingly useful as time goes on as a means of securing efficient operation of heating plants, for it furnishes the management of such plants with a means of checking the results with the weather variable eliminated from comparisons. Another wide use of the unit is closely akin to this one and consists of securing good use of fuel or heat on the part of the ultimate consumer.

One example is sufficient to indicate this application of the degree-day although there are a wide variety of applications and variations in use.

The method described is particularly applicable to commercial and institutional buildings where the primary use of fuel or steam is for the heating of buildings.

Based on past experience for a given building, a standard is set up of so many pounds of steam, pounds of coal, or gallons of oil which were used for that building per degree-day. As a number of buildings are to be considered, this constant can be reduced further to amount of fuel or steam per degree-day per 1,000 cubic feet of building volume or square feet of floor space so that it would be possible to compare one building with another.

A record of degree-days is kept each day and from this the standard based on previous experience is indicated in amount of fuel or steam per degree-day. The figure for the week, for example, is then compared with the standard and if approximately the same unit figure is arrived at, the plant is being operated as efficiently as during the previous period. If the figure is lower than the standard, then it has been operated more efficiently than formerly and consideration should be given to taking this into account in setting a new standard, or par. On the other hand, if the unit figure is higher than the standard, then something has happened to affect the operating efficiency and steps should be taken to improve the operation.

Naturally, in such a system the standard should be one that represents really good operating practice with clean boilers, good fuels and careful efficient operation.

It often happens that when such a standard is set up, the unit figure in fuel used per degree-day gradually increases from week to week rather than showing a sharp increase in any one week. This is due to the fact that as the boilers become dirty or the operator becomes more careless, the lessening efficiency is reflected in a gradual change in the unit figure.

An unusual but logical development in connection with the use of the degree-day for school buildings was reported from Salt Lake City a number of years ago. In this case, since schools are only open five days a week, a record was kept only of the degree-days on school days so that a comparison could be made on a more logical basis for this type of building.

Other uses of the degree-day include keeping a record of degree-days to show dissatisfied customers why their fuel bills are higher in one period than another.

For example, gas companies are frequently faced with this problem in explaining to customers why their gas bill goes up so sharply from November to December or from October to November. The consumer is aware, of course, that the weather is getting colder, but ordinarily the precise degree-day figures make more impression on

him than his own awareness of low temperature, which is a thing soon forgotten. Such methods are used not only by gas companies, but by fuel oil dealers and district steam utilities as well. In one case, a utility company even prints the number of degree-days on its bills. In this case, the number of degree-days for the period are covered by the bill.

Predicting Fuel Consumption

The use of the degree-day unit in predicting fuel consumption is of two different types: (1) predicting what the fuel consumption will be in an existing building for which performance data on fuel consumption during past periods are known, and (2) predicting fuel consumption for a new building or one with a new heating plant for which no previous comparable fuel data are available.

One of the best examples of the use of the degree-day for predicting fuel consumption for an existing building is that used in the fuel oil delivery business where, by use of the degree-day, fuel deliveries are simplified and the fuel oil dealer knows by his records exactly when to deliver fuel oil just prior to the tank being dangerously low.

As near as can be determined, the first use of the degree-day for this purpose was by Aetna Oil Service Co., Louisville, Ky., the system having been devised by W. R. Abbott of that company and reported by him in a talk before the American Society of Mechanical Engineers in 1928. The method used was somewhat as follows: a separate card was maintained for each customer and a constant K determined by dividing the gallons of oil used by that customer for a given period for which the number of degree-days was known. This K was then the gallons used per degree-day. Another constant K_1 was also kept, this being the gallons per degree-day per unit load, the unit load being assumed as 1,000 square feet of equivalent steam radiation. Also on the customer's card was entered the load on the boiler together with this equivalent load which was designated as C. K_1 was then determined by dividing K by the equivalent unit load C.

The constant K_1 was not necessary in connection with fuel deliveries, but was kept as an index of the overall efficiency of the plant and for comparing fuel consumption of that plant with other plants in the same city. It was of interest in evaluating the various types of building construction, insulation and weather stripping.

Since a record was kept each day of the number of degree-days, it was possible at short intervals to go through the cards and determine how much oil was used by each customer during that period and then subtract that from the previous known amount of fuel in the customer's tank. Consequently, it was quite easy to determine just when the customer's tank would become empty and anticipate this by a delivery of oil.

By adding the fuel consumption on all cards, it was possible to arrive at the number of gallons of oil needed by the company for its customers per degree-day so as to determine their own stocks. Obviously, too, truck schedules could be made up from information obtained from the cards so that the most efficient method of truck operation was possible.

Year-to-Year Variations

Basically, this same method is used today by the majority of fuel oil distributors, although the method of applying it varies from dealer to dealer.

The number of degree-days accumulated in a given locality for any period, such as in a month or a year necessarily varies from month to month and year to year. The following analysis by Anthracite Institute illustrates this fluctuation clearly.

To illustrate what remarkable shifts there have been in successive months, Weather Bureau records were analyzed back to the turn of the century, and the lowest and highest degree day totals for each month averaged for the cities of Boston, New York, Philadelphia, Scranton, Syracuse and Toronto. The years of warmest and coldest months did not coincide in many instances. For example, the coldest Januarys were in 1918 in New York, Philadelphia and Scranton, 1920 in Boston and Syracuse and 1912 in Toronto. On the other hand, 1917 marked the coldest December in each city, while the warmest December everywhere was in 1923.

Table 2 shows the average normals, the average degree days in the warmest and coldest months and deviations from normals.

TABLE 2—VARIATIONS IN MONTHLY DEGREE-DAYS IN SIX CITIES, 1899-1953
(From an analysis by Anthracite Institute)

Month	Number of Degree-Days				
	Normal	Average Warmest	Average Coldest	Compared with Normal: Warmest	Coldest
Sept.	92	27	193	— 65	+ 101
Oct.	346	176	555	— 170	+ 209
Nov.	652	454	852	— 198	+ 200
Dec.	1,014	785	1,319	— 229	+ 305
Jan.	1,119	774	1,447	— 345	+ 328
Feb.	1,016	804	1,411	— 212	+ 395
Mar.	859	544	1,106	— 315	+ 247
Apr.	519	334	687	— 185	+ 168
May	212	102	413	— 110	+ 201
June	42	7	132	— 35	+ 90
Total	5,871	4,007	8,115	—1,864	+2,244

The warmest months constituted a season 31.7% warmer than normal, the coldest 38.2% colder than normal. At the coldest, the heat demand would be more than double that in the warmest of record.

Degree-Day Tables

Subsequent pages of this section consist of two tables. The first are *normal* month to month and seasonal total figures; that is, they are long time averages which can be used in basic calculations. This covers 335 locations. The second table gives only normal yearly totals for 877 towns, cities, and villages.

The first table covers the 30-year period, 1921 to 1950, inclusive, and are those calculated by the U. S. Weather Bureau and released for publication late in 1953. In this table, *A* indicates an airport weather station, *C* a city office station.

The map accompanying these tables shows lines of constant degree-day normals and is included to show the overall picture of degree-days in the U. S.

The term "actual degree-days" is sometimes used. This refers to the number of degree-days for a specific month or year. Current degree-days or actual figures for 156 cities appear each month in HEATING AND VENTILATING.

NORMAL DEGREE-DAYS BY MONTHS FOR U. S. CITIES

City	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
ALABAMA													
Anniston–A	0	0	17	118	438	614	614	485	381	128	25	0	2820
Birmingham–A	0	0	13	123	396	598	623	491	378	128	30	0	2780
Mobile–A	0	0	0	28	219	376	416	304	222	47	0	0	1612
Mobile–C	0	0	0	23	198	357	412	290	209	40	0	0	1529
Montgomery–A	0	0	0	69	304	491	517	388	288	80	0	0	2137
Montgomery–C	0	0	0	55	267	458	483	360	265	66	0	0	1954
ARIZONA													
Flagstaff–A	49	78	243	586	876	1135	1231	1014	949	687	465	212	7525
Phoenix–A	0	0	0	22	223	400	474	309	196	74	0	0	1698
Phoenix–C	0	0	0	13	182	360	425	275	175	62	0	0	1492
Prescott–A	0	0	34	261	582	843	921	717	626	368	164	17	4533
Tuscon–A	0	0	0	24	222	403	474	330	239	84	0	0	1776
Winslow–A	0	0	20	274	663	946	1001	706	605	335	144	8	4702
Yuma–A	0	0	0	0	105	259	318	167	88	14	0	0	951
ARKANSAS													
Fort Smith–A	0	0	9	131	435	698	775	571	418	127	24	0	3188
Little Rock–A	0	0	10	110	405	654	719	543	401	122	18	0	2982
Texarkana–A	0	0	0	69	317	527	600	441	324	84	0	0	2362
CALIFORNIA													
Bakersfield–A	0	0	0	41	273	505	561	350	259	105	21	0	2115
Beaumont–C	0	0	18	103	298	487	574	473	437	286	146	18	2840
Bishop–A	0	0	55	253	564	803	840	664	546	319	140	38	4222
Blue Canyon–A	36	41	105	369	633	822	893	809	815	597	397	202	5719
Burbank–A	0	0	11	59	186	324	396	308	265	152	85	22	1808
Eureka–C	267	248	264	335	411	508	552	465	493	432	375	282	4632
Fresno–A	0	0	0	86	345	580	629	400	304	145	43	0	2532
Los Angeles–A	31	22	56	87	200	301	378	305	273	185	121	56	2015
Los Angeles–C	0	0	17	41	140	253	328	244	212	129	68	19	1451
Mount Shasta–C	37	46	165	434	705	939	998	787	722	549	357	174	5913
Oakland–A	84	77	76	157	336	508	552	400	360	282	212	119	3163
Red Bluff–A	0	0	0	59	319	564	617	423	336	177	51	0	2546
Sacramento–A	0	0	22	98	357	595	642	428	348	222	103	7	2822
Sacramento–C	0	0	17	75	321	567	614	403	317	196	85	5	2600
Sandberg–C	0	0	26	211	465	701	781	678	629	435	261	56	4243
San Diego–A	11	7	24	52	147	255	317	247	223	151	97	43	1574
San Francisco–A	144	136	101	174	318	487	530	398	378	327	264	164	3421
San Francisco–C	189	177	110	128	237	406	462	336	317	279	248	180	3069
San Jose–C	7	11	26	97	270	450	487	342	308	229	137	46	2410
Santa Catalina–A	21	11	24	77	168	311	375	328	344	264	205	121	2249
Santa Maria–A	98	94	111	157	262	391	453	370	341	276	229	152	2934
COLORADO													
Alamosa–A	64	121	309	648	1065	1414	1491	1176	1029	699	440	203	8659
Colorado Springs–A	8	21	124	422	777	1039	1122	930	874	555	307	75	6254
Denver–A	5	11	120	425	771	1032	1125	924	843	525	286	65	6132
Denver–C	0	5	103	385	711	958	1042	854	797	492	266	60	5673
Grand Junction–A	0	0	36	333	792	1132	1271	924	738	402	145	23	5796
Pueblo–A	0	0	74	383	771	1051	1104	865	775	456	203	27	5709
CONNECTICUT													
Bridgeport–A	0	0	66	334	645	1014	1110	1008	871	561	249	38	5896
Hartford–A	0	14	101	384	699	1082	1178	1050	871	528	201	31	6139
New Haven–A	0	18	93	363	663	1026	1113	1005	865	567	261	52	6026
DELAWARE													
Wilmington–A	0	0	47	282	585	927	983	876	698	396	110	6	4910

City	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
DISTRICT OF COLUMBIA													
Washington–A	0	0	37	237	519	837	893	781	619	323	87	0	4333
Washington–C	0	0	32	231	510	831	884	770	606	314	80	0	4258
Silver Hill Obs.	0	0	53	270	549	865	918	798	632	347	107	0	4539
FLORIDA													
Apalachicola–C	0	0	0	17	154	304	352	263	184	33	0	0	1307
Daytona Beach–A	0	0	0	0	83	205	245	187	137	11	0	0	868
Fort Myers–A	0	0	0	0	25	101	124	95	60	0	0	0	405
Jacksonville–A	0	0	0	16	148	309	331	247	169	23	0	0	1243
Jacksonville–C	0	0	0	11	129	276	303	226	154	14	0	0	1113
Key West–A	0	0	0	0	0	22	34	25	8	0	0	0	89
Key West–C	0	0	0	0	0	18	28	24	7	0	0	0	77
Lakeland–C	0	0	0	0	60	167	185	142	95	0	0	0	649
Melbourne–A	0	0	0	0	44	127	169	121	76	0	0	0	537
Miami–A	0	0	0	0	8	52	58	48	12	0	0	0	178
Miami–C	0	0	0	0	5	48	57	48	15	0	0	0	173
Miami Beach	0	0	0	0	0	37	43	34	9	0	0	0	123
Orlando–A	0	0	0	0	61	161	188	148	92	0	0	0	650
Pensacola–C	0	0	0	18	177	334	383	275	203	45	0	0	1435
Tallahassee–A	0	0	0	31	209	366	385	287	203	38	0	0	1519
Tampa–A	0	0	0	0	60	163	201	148	102	0	0	0	674
W. Palm Beach–A	0	0	0	0	7	62	85	61	33	0	0	0	248
GEORGIA													
Albany–A	0	0	0	39	242	427	446	333	236	40	0	0	1763
Athens–A	0	0	5	100	390	614	629	515	404	128	15	0	2800
Atlanta–A	0	0	8	110	393	614	632	512	404	133	20	0	2826
Atlanta–C	0	0	8	107	387	611	632	515	392	135	24	0	2811
Augusta–A	0	0	0	59	282	494	521	412	308	62	0	0	2138
Columbus–A	0	0	0	78	326	547	563	437	348	97	0	0	2396
Macon–A	0	0	0	63	280	481	497	391	275	62	0	0	2049
Rome–A	0	0	8	140	435	673	700	560	436	159	27	0	3138
Savannah–A	0	0	0	38	225	412	424	330	238	43	0	0	1710
Valdosta–A	0	0	0	32	203	366	386	290	210	38	0	0	1525
IDAHO													
Boise–A	0	0	135	389	762	1054	1169	868	719	453	249	92	5890
Lewiston–A	0	0	133	406	747	961	1060	815	663	408	222	68	5483
Pocatello–A	0	0	183	487	873	1184	1333	1022	880	561	317	136	6976
Salmon	22	55	292	592	996	1380	1513	1103	905	561	334	169	7922
ILLINOIS													
Cairo–C	0	0	28	161	492	784	856	683	523	182	47	0	3756
Chicago–A	0	0	90	350	765	1147	1243	1053	868	507	229	58	6310
Joliet–A	0	16	114	390	798	1190	1277	1084	893	519	233	64	6578
Moline–A	0	8	96	363	786	1181	1296	1075	862	453	199	45	6364
Peoria–A	0	11	86	339	759	1128	1240	1028	828	435	192	41	6087
Springfield–A	0	6	83	315	723	1066	1166	958	769	404	171	32	5693
Springfield–C	0	0	56	259	666	1017	1116	907	713	350	127	14	5225
INDIANA													
Evansville–A	0	0	59	215	570	871	939	770	589	251	90	6	4360
Fort Wayne–A	0	17	107	377	759	1122	1200	1036	874	516	226	53	6287
Indianapolis–A	0	0	79	306	705	1051	1122	938	772	432	176	30	5611
Indianapolis–C	0	0	59	247	642	986	1051	893	725	375	140	16	5134
South Bend–A	5	13	101	381	789	1153	1252	1081	908	531	248	62	6524
Terre Haute–A	0	5	77	295	681	1023	1107	913	725	371	145	24	5366
IOWA													
Burlington–A	0	0	83	336	765	1150	1271	1036	822	425	179	34	6101
Charles City–C	17	30	151	444	912	1352	1494	1240	1001	537	256	70	7504
Davenport–C	0	7	79	320	756	1147	1262	1044	834	432	175	35	6091

City	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
IOWA (Concluded)													
Des Moines–A	5	12	99	355	798	1203	1330	1092	868	438	201	45	6446
Des Moines–C	0	6	89	346	777	1178	1308	1072	849	425	183	41	6274
Dubuque–A	8	28	149	444	882	1290	1414	1187	983	543	267	76	7271
Sioux City–A	8	17	128	405	885	1290	1423	1170	930	474	228	54	7012
KANSAS													
Concordia–C	0	0	55	277	687	1029	1144	899	725	341	146	20	5323
Dodge City–A	0	0	40	262	669	980	1076	840	694	347	135	15	5058
Goodland–A	0	0	95	413	825	1128	1215	974	884	534	241	58	6367
Topeka–A	0	8	59	271	672	1017	1125	885	694	326	137	15	5209
Topeka–C	0	0	42	242	630	977	1088	851	669	295	112	13	4919
Wichita–A	0	0	32	219	597	915	1023	778	619	280	101	7	4571
KENTUCKY													
Bowling Green–A	0	0	47	215	558	840	890	739	601	286	98	5	4279
Lexington–A	0	0	56	259	636	933	1008	854	710	368	140	15	4979
Louisville–A	0	0	51	232	579	871	933	778	611	285	94	5	4439
Louisville–C	0	0	41	206	549	849	911	762	605	270	86	0	4279
LOUISIANA													
Baton Rouge–A	0	0	0	27	215	373	424	293	215	48	0	0	1595
Burrwood	0	0	0	0	81	225	303	226	169	29	0	0	1033
Lake Charles–A	0	0	0	22	218	353	416	284	210	40	0	0	1543
New Orleans–A	0	0	0	7	169	308	364	248	190	31	0	0	1317
New Orleans–C	0	0	0	5	141	283	341	223	163	19	0	0	1175
Shreveport–A	0	0	0	53	305	490	550	386	272	61	0	0	2117
MAINE													
Caribou–A	85	133	354	710	1074	1562	1745	1546	1342	909	512	201	10173
Eastport–C	141	136	261	521	798	1206	1333	1201	1063	774	524	288	8246
Portland–A	15	56	199	515	825	1237	1373	1218	1039	693	394	117	7681
MARYLAND													
Baltimore–A	0	0	43	256	558	884	942	820	651	360	97	0	4611
Baltimore–C	0	0	29	207	489	812	880	776	611	326	73	0	4203
Frederick–A	0	0	47	276	588	930	1001	865	673	368	106	0	4854
MASSACHUSETTS													
Boston–A	0	7	77	315	618	998	1113	1002	849	534	236	42	5791
Nantucket–A	22	34	111	372	615	924	1020	949	880	642	394	139	6102
Pittsfield–A	25	63	213	543	843	1246	1358	1212	1060	690	336	105	7694
MICHIGAN													
Alpena–C	50	85	215	530	864	1218	1358	1263	1156	762	437	135	8073
Detroit-Willow Run–A	0	10	96	393	759	1125	1231	1089	915	552	244	55	6469
Detroit–A	0	8	96	381	747	1101	1203	1072	927	558	251	60	6404
Escanaba–C	62	95	247	555	933	1321	1473	1327	1203	804	471	166	8657
Grand Rapids–A	14	29	144	462	822	1169	1287	1154	1008	606	301	79	7075
Grand Rapids–C	0	20	105	394	756	1107	1215	1086	939	546	248	58	6474
Lansing–A	13	33	140	455	813	1175	1277	1142	986	591	287	70	6982
Marquette–C	69	87	236	543	933	1299	1435	1291	1181	789	477	189	8529
Muskegon–A	26	48	152	462	795	1110	1243	1134	1011	642	350	116	7089
Sault Ste. Marie–A	109	126	298	639	1005	1398	1587	1442	1302	846	499	224	9475
MINNESOTA													
Duluth–A	56	91	298	651	1140	1606	1758	1512	1327	846	474	178	9937
Duluth–C	66	91	277	614	1092	1550	1696	1448	1252	801	487	200	9574
Internat'l Falls–A	70	118	356	716	1230	1733	1922	1618	1395	834	437	171	10600
Minneapolis–A	8	17	157	459	960	1414	1562	1310	1057	570	259	80	7853
Rochester–A	24	38	182	499	975	1426	1572	1316	1073	600	298	92	8095
Saint Cloud–A	32	53	225	570	1068	1535	1690	1439	1181	663	331	106	8893
Saint Paul–A	12	21	154	459	951	1401	1553	1305	1051	564	256	77	7804

City	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
MISSISSIPPI													
Jackson–A	0	0	0	69	310	503	535	405	299	81	0	0	2202
Meridian–A	0	0	0	90	338	528	561	413	309	85	9	0	2333
Vicksburg–C	0	0	0	51	268	456	507	374	273	71	0	0	2000
MISSOURI													
Columbia–A	0	6	62	262	654	989	1091	876	698	326	135	14	5113
Kansas City–A	0	0	44	240	621	970	1085	851	666	292	111	8	4888
Saint Joseph–A	0	5	49	265	681	1048	1175	930	716	326	127	14	5336
Saint Louis–A	0	0	45	233	600	927	1017	820	648	297	101	11	4699
Saint Louis–C	0	0	38	202	570	893	983	792	620	270	94	7	4469
Springfield–A	0	8	61	249	615	908	1001	790	632	295	118	16	4693
MONTANA													
Billings–A	8	20	194	497	876	1172	1305	1089	958	564	304	119	7106
Butte–A	115	174	450	744	1104	1442	1575	1294	1172	804	561	325	9760
Glasgow–C	14	30	244	574	1086	1510	1683	1408	1119	597	312	113	8690
Great Falls–A	24	50	273	524	894	1194	1311	1131	1008	621	359	166	7555
Havre–C	20	38	270	564	1023	1383	1513	1291	1076	597	313	125	8213
Helena–A	36	66	320	617	999	1311	1469	1165	1017	654	399	197	8250
Helena–C	51	78	359	598	969	1215	1438	1114	992	660	427	225	8126
Kalispell–A	47	83	326	639	990	1249	1386	1120	970	639	391	215	8055
Miles City–A	6	11	187	525	966	1373	1516	1229	1048	570	285	106	7822
Missoula–A	22	57	292	623	993	1283	1414	1100	939	609	365	176	7873
NEBRASKA													
Grand Island–A	0	6	84	369	822	1178	1302	1044	849	423	195	39	6311
Lincoln–A	0	12	82	340	774	1144	1271	1030	822	401	190	38	6104
Lincoln–C	0	7	79	310	741	1113	1240	1000	794	377	172	32	5865
Norfolk–A	0	17	122	422	903	1280	1417	1159	933	501	251	60	7065
North Platte–A	7	11	120	425	846	1172	1271	1016	887	489	243	59	6546
Omaha–A	0	5	88	331	783	1166	1302	1058	831	389	175	32	6160
Scottsbluff–A	0	0	137	456	867	1178	1287	1030	933	567	305	81	6841
Valentine–C	11	10	145	461	891	1212	1361	1100	970	543	288	83	7075
NEVADA													
Elko–A	6	28	229	546	915	1181	1336	1025	896	612	378	183	7335
Ely–A	22	44	228	561	894	1181	1302	1033	921	639	418	200	7443
Las Vegas–C	0	0	0	61	344	564	653	423	288	92	0	0	2425
Reno–A	27	61	165	443	744	986	1048	804	756	519	318	165	6036
Tonopah	0	5	96	422	723	995	1082	860	763	504	272	91	5813
Winnemucca–A	0	17	180	508	822	1085	1153	854	794	546	299	111	6369
NEW HAMPSHIRE													
Concord–A	11	57	192	527	849	1271	1392	1226	1029	660	316	82	7612
NEW JERSEY													
Atlantic City–C	0	0	29	230	507	831	905	829	729	468	189	24	4741
Newark–A	0	0	47	301	603	961	1039	932	760	450	148	11	5252
Trenton–C	0	0	55	285	582	930	1004	904	735	429	133	11	5068
NEW MEXICO													
Albuquerque–A	0	0	10	218	630	899	970	714	589	289	70	0	4389
Clayton–A	0	0	68	318	678	927	995	795	729	420	184	24	5138
Raton–A	17	36	148	431	798	1104	1203	924	834	543	292	87	6417
Roswell–A	0	0	8	156	501	750	787	566	443	185	28	0	3424
NEW YORK													
Albany–A	0	24	139	443	780	1197	1318	1179	989	597	246	50	6962
Albany–C	0	6	98	388	708	1113	1234	1103	905	531	202	31	6319
Bear Mountain–C	0	25	119	409	753	1110	1212	1098	921	561	244	59	6511
Binghamton–A	16	63	192	518	834	1228	1342	1215	1051	672	318	88	7537

City	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
NEW YORK (Concluded)													
Binghamton–C	0	36	141	428	735	1113	1218	1100	927	570	240	48	6556
Buffalo–A	16	30	122	433	753	1116	1225	1128	992	636	315	72	6838
New York–La Guard.–A	0	0	28	250	546	908	992	907	760	447	141	10	4989
New York–C	0	0	39	263	561	908	995	904	753	456	153	18	5050
New York–Central Pk.	0	0	31	250	552	902	1001	910	747	435	130	7	4965
Oswego–C	20	39	139	430	738	1132	1249	1134	995	654	355	90	6975
Rochester–A	9	34	133	440	759	1141	1249	1148	992	615	289	54	6863
Schenectady–C	0	19	137	456	792	1212	1349	1207	1008	597	233	40	7050
Syracuse–A	0	29	117	396	714	1113	1225	1117	955	570	247	37	6520
NORTH CAROLINA													
Asheville–C	0	0	50	262	552	769	794	678	572	285	105	5	4072
Charlotte–A	0	0	7	147	438	682	704	577	449	172	29	0	3205
Greensboro–A	0	0	29	202	510	772	806	672	528	241	50	0	3810
Hatteras–C	0	0	0	63	244	481	527	487	394	171	25	0	2392
Raleigh–A	0	0	16	149	438	701	732	613	477	202	41	0	3369
Raleigh–C	0	0	10	118	387	651	691	577	440	172	29	0	3075
Wilmington–A	0	0	0	73	288	508	533	463	347	104	7	0	2323
Winston-Salem–A	0	0	28	182	492	756	797	666	519	232	49	0	3721
NORTH DAKOTA													
Bismarck–A	29	37	227	598	1098	1535	1730	1464	1187	657	355	116	9033
Devils Lake–C	47	61	276	654	1197	1668	1866	1576	1314	750	394	137	9940
Fargo–A	25	41	215	586	1122	1615	1795	1518	1231	687	338	101	9274
Williston–C	29	42	261	605	1101	1528	1705	1442	1194	663	360	138	9068
OHIO													
Akron-Canton–A	0	17	83	378	738	1082	1166	1033	884	537	235	50	6203
Cincinnati–A	0	6	77	295	648	973	1029	871	732	392	149	23	5195
Cincinnati–C	0	0	42	222	567	880	942	812	645	314	108	0	4532
Cincinnati-Abbe Obs.	0	0	56	263	612	930	989	846	682	347	132	13	4870
Cleveland–A	0	10	75	340	699	1057	1132	1019	874	531	223	46	6006
Cleveland–C	0	9	60	311	636	995	1101	977	846	510	223	49	5717
Columbus–A	0	8	69	337	693	1032	1094	946	781	444	180	31	5615
Columbus–C	0	0	59	299	654	983	1051	907	741	408	153	22	5277
Dayton–A	0	5	74	324	693	1032	1094	941	781	435	179	39	5597
Sandusky–C	0	0	66	327	684	1039	1122	997	853	513	217	41	5859
Toledo–A	0	12	102	387	756	1119	1197	1056	905	555	245	60	6394
Youngstown–A	0	19	83	355	732	1085	1163	1030	877	534	241	53	6172
OKLAHOMA													
Oklahoma City–A	0	0	14	154	480	769	865	650	490	182	40	0	3644
Oklahoma City–C	0	0	12	149	459	747	843	630	472	169	38	0	3519
Tulsa–A	0	0	18	152	462	750	856	644	485	173	44	0	3584
OREGON													
Astoria–A	138	111	146	338	537	691	772	613	611	459	357	222	4995
Baker–C	25	47	255	518	852	1138	1268	972	837	591	384	200	7087
Burns–C	10	37	219	552	855	1156	1274	946	809	552	349	159	6918
Eugene–A	33	34	144	381	591	756	831	624	567	423	270	125	4779
Meacham–A	88	102	294	605	903	1113	1243	1008	961	717	527	327	7888
Medford–A	0	0	77	326	624	822	862	627	552	381	207	69	4547
Pendleton–A	0	0	104	353	717	921	1066	795	614	386	197	51	5204
Portland–A	25	22	116	319	585	750	856	658	570	396	242	93	4632
Portland–C	13	14	85	280	534	701	791	594	515	347	199	70	4143
Roseburg–C	14	10	98	288	531	694	744	563	508	366	223	83	4122
Salem–A	21	23	113	326	588	744	825	622	564	408	249	91	4574
Sexton Summit	88	69	169	456	714	877	905	801	797	621	450	270	6217
Troutdale–A	33	31	131	335	591	766	874	664	574	405	256	115	4775

City	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
PENNSYLVANIA													
Allentown–A	0	9	89	366	690	1051	1132	1019	840	495	164	25	5880
Erie–C	0	17	76	352	672	1020	1128	1039	911	573	273	55	6116
Harrisburg–A	0	0	69	308	630	964	1051	921	750	423	128	14	5258
Park Place–C	14	57	173	484	807	1200	1277	1142	998	648	290	85	7175
Philadelphia–A	0	0	47	269	573	902	986	879	704	402	104	0	4866
Philadelphia–C	0	0	33	219	516	856	933	837	667	369	93	0	4523
Pittsburgh-Allegheny–A	0	6	78	336	678	1004	1073	955	784	447	167	27	5555
Pittsburgh-Gr. Pitt.–A	0	20	94	377	720	1057	1116	986	818	486	195	36	5905
Pittsburgh–C	0	0	56	298	612	924	992	879	735	402	137	13	5048
Reading–C	0	5	57	285	588	936	1017	902	725	411	123	11	5060
Scranton–C	0	18	115	389	693	1057	1141	1028	859	516	196	35	6047
Williamsport–A	0	16	101	377	699	1057	1132	1005	828	477	181	25	5898
RHODE ISLAND													
Block Island–A	6	21	88	330	591	927	1026	955	865	603	335	96	5843
Providence–A	0	26	107	381	672	1035	1125	1019	874	570	258	58	6125
Providence–C	0	7	68	330	624	986	1076	972	809	507	197	31	5607
SOUTH CAROLINA													
Charleston–A	0	0	0	52	270	456	472	379	281	63	0	0	1973
Charleston–C	0	0	0	34	214	410	445	363	260	43	0	0	1769
Columbia–A	0	0	0	82	338	558	566	468	340	83	0	0	2435
Columbia–C	0	0	0	76	308	524	538	443	318	77	0	0	2284
Florence–A	0	0	0	94	347	574	588	487	334	83	0	0	2507
Greenville–A	0	0	10	131	411	648	673	552	442	161	32	0	3060
Spartanburg–A	0	0	7	136	414	654	670	549	436	152	26	0	3044
SOUTH DAKOTA													
Huron–A	10	16	149	472	975	1407	1597	1327	1032	558	279	80	7902
Rapid City–A	32	24	193	500	891	1218	1361	1151	1045	615	357	148	7535
Sioux Falls–A	16	21	155	472	984	1414	1575	1274	1023	558	276	80	7848
TENNESSEE													
Bristol–A	0	0	58	239	576	815	818	697	576	274	95	0	4148
Chattanooga–A	0	0	24	169	477	710	725	588	467	179	45	0	3384
Knoxville–A	0	0	33	179	498	744	760	630	500	196	50	0	3590
Memphis–A	0	0	17	126	432	673	725	574	427	139	24	0	3137
Memphis–C	0	0	13	98	392	639	716	574	423	131	20	0	3006
Nashville–A	0	0	22	154	471	725	778	636	498	186	43	0	3513
TEXAS													
Abilene–A	0	0	5	98	350	595	673	479	344	113	0	0	2657
Amarillo–A	0	0	37	240	594	859	921	711	586	298	99	0	4345
Austin–A	0	0	0	30	214	402	484	322	211	50	0	0	1713
Big Springs–A	0	0	0	75	316	577	639	454	314	105	0	0	2480
Brownsville–A	0	0	0	0	59	159	219	106	74	0	0	0	617
Corpus Christi–A	0	0	0	0	113	252	330	192	118	6	0	0	1011
Dallas–A	0	0	0	53	299	518	607	432	288	75	0	0	2272
Del Rio–A	0	0	0	26	188	371	419	235	147	21	0	0	1407
El Paso–A	0	0	0	70	390	626	670	445	330	110	0	0	2641
Fort Worth–A	0	0	0	58	299	533	622	446	308	90	5	0	2361
Ft. Worth–A. Carter Fld.	0	0	0	57	299	524	619	432	326	81	0	0	2338
Galveston–A	0	0	0	0	132	286	362	249	176	28	0	0	1233
Galveston–C	0	0	0	0	131	271	356	247	176	30	0	0	1211
Houston–A	0	0	0	7	181	321	394	265	184	36	0	0	1388
Houston–C	0	0	0	0	162	303	378	240	166	27	0	0	1276
Laredo–A	0	0	0	0	91	215	270	134	71	0	0	0	781
Lubbock–A	0	0	23	173	492	756	812	613	481	201	36	0	3587
Palestine–C	0	0	0	45	260	440	531	368	265	71	0	0	1980
Port Arthur–A	0	0	0	20	218	349	406	274	211	39	0	0	1517
Port Arthur–C	0	0	0	8	170	315	381	258	181	27	0	0	1340
San Angelo–A	0	0	0	72	280	502	556	378	257	62	0	0	2107

City	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
TEXAS (Concluded)													
San Antonio–A	0	0	0	25	201	374	462	293	190	34	0	0	1579
Victoria–A	0	0	0	0	131	277	352	209	143	14	0	0	1126
Waco–A	0	0	0	44	251	459	557	385	263	66	0	0	2025
Wichita Falls–A	0	0	5	115	404	657	756	538	394	140	16	0	3025
UTAH													
Blanding	0	0	100	409	792	1079	1190	913	800	510	272	73	6138
Milford–A	0	0	114	462	828	1147	1277	955	800	516	269	77	6445
Salt Lake City–A	0	0	88	381	771	1039	1194	885	741	453	233	81	5866
Salt Lake City–C	0	0	61	330	714	995	1119	857	701	414	208	64	5463
VERMONT													
Burlington–A	19	47	172	521	858	1308	1460	1313	1107	681	307	72	7865
VIRGINIA													
Cape Henry–C	0	0	0	120	366	648	698	636	512	267	60	0	3307
Lynchburg–A	0	0	49	236	531	808	846	722	584	289	82	5	4153
Norfolk–A	0	0	9	152	408	688	729	644	500	265	59	0	3454
Norfolk–C	0	0	5	118	354	636	679	602	464	220	41	0	3119
Richmond–A	0	0	33	210	498	791	828	708	550	271	66	0	3955
Richmond–C	0	0	31	181	456	750	787	675	529	254	57	0	3720
Roanoke–A	0	0	50	233	543	806	840	722	588	289	81	0	4152
WASHINGTON													
Ellensburg–A	13	17	176	496	849	1116	1268	949	753	504	296	105	6542
Kelso–A	85	84	186	409	636	784	856	652	605	453	316	173	5239
Northhead	239	205	234	341	486	636	704	585	598	492	406	285	5211
Olympia–A	91	83	207	434	645	794	868	700	660	498	338	183	5501
Omak	0	46	194	533	921	1212	1352	1061	781	453	222	59	6834
Port Angeles–A	233	226	303	459	603	719	772	652	645	519	422	297	5850
Seattle–C	49	45	134	329	540	679	753	602	558	396	246	107	4438
Seattle-Tacoma–A	75	70	192	412	633	781	862	675	636	477	307	155	5275
Spokane–A	17	28	205	508	879	1113	1243	988	834	561	330	146	6852
Stampede Pass	251	260	414	701	1002	1203	1280	1064	1063	837	636	438	9149
Tacoma–C	66	62	177	375	579	719	797	636	595	435	282	143	4866
Tattosh Island–C	295	288	315	406	528	648	713	610	629	525	437	330	5724
Walla Walla–C	0	0	93	308	675	890	1023	748	564	338	171	38	4848
Yakima–A	0	7	150	446	807	1066	1181	862	660	408	205	53	5845
WEST VIRGINIA													
Charleston–A	0	0	60	250	576	834	887	750	632	310	110	8	4417
Elkins–A	9	31	122	412	726	995	1017	910	797	477	224	53	5773
Huntington–C	0	0	35	210	549	803	837	728	570	251	85	5	4073
Parkersburg–C	0	0	56	272	600	896	949	826	672	347	119	13	4750
Petersburg–C	0	5	72	308	654	942	967	820	667	384	133	14	4966
WISCONSIN													
Green Bay–A	32	58	183	515	945	1392	1516	1336	1132	696	347	107	8259
LaCrosse–A	11	20	152	447	921	1380	1528	1280	1035	552	250	74	7650
Madison–A	13	31	150	459	891	1302	1423	1207	1008	579	272	82	7417
Madison–C	10	30	137	419	864	1287	1417	1207	1011	573	266	79	7300
Milwaukee–A	20	32	134	428	831	1218	1336	1142	983	621	351	109	7205
Milwaukee–C	11	24	112	397	795	1184	1302	1117	961	606	335	100	6944
WYOMING													
Casper–A	13	24	231	577	951	1225	1324	1095	1011	660	381	146	7638
Cheyenne–A	33	39	241	577	897	1125	1225	1044	1029	717	462	173	7562
Lander–A	7	23	244	632	1050	1383	1494	1179	1045	687	396	163	8303
Rock Springs–A	20	32	266	648	1038	1349	1457	1182	1110	735	443	193	8473
Sheridan–A	27	41	239	578	957	1271	1392	1170	1035	645	387	161	7903

NORMAL YEARLY TOTAL DEGREE-DAYS FOR 877 U. S. CITIES

The data which follow give the seasonal total number of degree days for the heating season for 877 towns, villages, and cities not covered in the previous table in which the data are given by months.

Figures in this table were compiled by using normal monthly mean temperatures for each station and are based on these monthly normal figures for periods as long as 50 years and at least 20 years. They are not official figures of the U. S. Weather Bureau, with certain exceptions, but were calculated from publications of the Weather Bureau.

The exceptions are those stations marked with a dagger for which the figures are those calculated by the U. S. Weather Bureau.

Consequently, to arrive at the seasonal totals given, the monthly figures had to be calculated. The only reason these monthly figures are not presented here is due to lack of space but, since they are available, they can be obtained from HEATING AND VENTILATING on request for individual cities or small groups of cities.

In using this table, first check to see whether the city is covered in the more complete monthly tabulation which precedes this table.

ALABAMA

Ashville	2882
Bermuda	1816
Camp Hill	2251
Clanton	2408
Decatur	3047
Eufaula	2147
Gadsden	2903
Hamilton	2864
Healing Springs	2263
Livingston	2373
Ozark	1737
Riverton	3497
Scottsboro	3153
Tuscaloosa	2529
Valley Head	3319

ARIZONA

Alpine Ranger Sta.	7859
Casa Grande	1283
Chin Lee	5908
Clifton	2184
Congress	1666
Douglas	2627
Fort Apache	4922
Granite Reef Dam	1418
Kayenta	5317
Leupp	5311
Miami	2418
Moccasin	5320
Nogales	2516
Parker	1518
Payson	4496
Pinto	5395
Salome	2143
San Carlos	2257
Seligman	5004
Sentinel	1181
Supai	2722
Truxton	3375
Willcox	3326

ARKANSAS

Arkadelphia	2500
Batesville	3429
Bentonville†	4036
Bergman	3957
Corning	3703
Dardanelle	3014
Dumas	2303
Dutton	4167
El Dorado	2295
Helena	2764
Mammoth Spring	3716
Mena	2945
Mountain Home	3537
Okay	3430
Osceola	3141
Portland	2158
Stuttgart	2835
Wynne	3066

CALIFORNIA

Alturas	6673
Bagdad	1141
Barstow	2299
Berkeley	3269
Blythe	1740
Branscomb	4342
Burney	6163
Cahuilla	4920
Calexico	1089
China Flat	3524
Cloverdale	2703
Crescent City	4711
Cuyamaca	5245
Davis	2899
Delta	3088
Downieville	4873
Emigrant Gap	5613
Eureka†	4758
Fort Bidwell	6680
Georgetown	3737
Grass Valley	3754
Greenland Ranch	1088
Healdsburg	2728
Hollister	2651
Independence†	3834
King City	2408
Lick Observatory	4972
Livermore	2473
Lone Pine	3799
Macdoel	7732
Madeline	8015
Marysville	2498
McCloud	6053
Mecca	1175
Merced	2473
Mojave	2463
Montague	5423
Mount Tamalpais	3867
Needles	1251
Oceanside	1653
Oroville	2513
Pasadena	2067
Placerville	3959
Point Reyes†	4474
Pomona	2284
Quincy	5724
St. Helena	2869
San Bernardino	1879
San Luis Obispo	2382
Santa Barbara	1995
Santa Clara	3087
Santa Cruz	2812
Santa Monica	2121
Sterling	852
Stockton	2675
Storey	2942
Susanville	6140
Tulare	2301
Upper Lake	3367
Weaverville	4662
West Branch	5040
Willows	2670
Yosemite	5345

COLORADO

Akron	6724
Arriba	6392
Blue Valley Ranch	9759
Boulder	5535
Buena Vista	8852
Burlington	5875
Cheesman	6898
Cheyenne Wells	5936
Delta	6063
Dillon	11515
Dolores	6826
Durango†	7143
Fort Lewis	7646
Fraser	12023
Fruita	6205
Garnett	8634
Grand Junction†	5613
Grover	7305
Gunnison	10218
Hamps	6939
Holly	5070
Huerfano	6159
Husted	6743
Julesburg	6435
Lake City	9320
Las Animas	5595
Lay	8337
Leadville†	10678
Manassa	8285
Nast	10383
Pagosa Springs	8512
Rangely	7887
Redvale	7054
Rifle	6642
Salida	7167
San Luis	8229
Steamboat Spr'gs	9630
Trinidad	5326
Two Buttes	1042
Wagon Wheel Gap	10833
Wray	5828

CONNECTICUT

Cream Hill	7136
N. Grosvenordale	6799

DELAWARE

Delaware City	4913
Dover	4591
Milford	4393
Millsboro	4527
Seaford	4551

FLORIDA

Avon Park	198
Bradentown	354
Cedar Keys	632
Fort Lauderdale	0
Gainesville	732
Monticello	1129
Okeechobee	112
St. Augustine	1116
Titusville	345

GEORGIA

Americus	1895
Bainbridge	1473
Brunswick	1268
Carrollton	2806
Clayton	3611
Concord	2597
Covington	2776
Diamond	3658
Dublin	2106
Eastman	1816
Elberton	2728
Fitzgerald	1658
Fort Gaines	1802
Gainesville	3239
Gillsville	2969
Glennville	1623
Griffin	2508
Harrison	2183
Marshallville	2019
Milledgeville	2335
Millen	1969
Ramhurst	3216
St. George	1168
St. Marys	1190
Statesboro	1769
Talbotton	2206
Thomasville†	1513
Valona	1484
Washington	2655
Waycross	1471
Waynesboro	2090
West Point	2435

IDAHO

Ashton	8667
Avery	6947
Glenns Ferry	5684
Grace	7551
Kooskia	6009
Mackay	8609
New Meadows	8525
Oakley	6458
Sandpoint	7326
Springfield	7477

ILLINOIS

Antioch	6897
Aurora	6661
Bloomington	5693
Danville	5391
Decatur	5485
Freeport	7052
Griggsville	5275
Harrisburg	4076
Havana	5365
Henry	6089
Hillsboro	5009
La Harpe	5815
Mt. Carmel	4725
Mt. Vernon	4691
Palestine	5015
Pontiac	5796
Quincy	5302
Rockford	6847
Urbana	5805

INDIANA

Anderson	5441
Angola	6349
Auburn	6522
Bedford	4682
Bloomington	4768
Bluffton	5867
Columbus	5255
Connersville	5452
Crawfordsville	5336
Delphi	5909
Greencastle	5389
Greensburg	5274
Hammond	6240
Howe	6472
Huntingburg	4372
Huntington	5884
Jeffersonville	4325
Kokomo	5594
Lafayette	5816
Laporte	5797
Logansport	5798
Madison	4472
Marion	5715
Plymouth	6149
Princeton	4639
Richmond	5757
Rome	4010
Royal Center†	6239
Seymour	4817
Shelbyville	5106
Valparaiso	6350
Vincennes	4776
Washington	4639
Whiting	5993
Winona Lake	5896

IOWA

Algona	7420
Bonaparte	6041
Clarinda	6285
Corydon	6087
Cresco	8369
Denison	6802
Guthrie Center	6573
Independence	7177
Keokuk†	5663
Marshalltown	6853
Mason City	7566
Rockwell City	7008
Sibley	7912
Washington	6322
Webster City	6781

KANSAS

Burr Oak	5657
Colby	5639
Emporia	4694
Fort Scott	4379
Hanover	5243
Hays	5277
Healy	5275
Hutchinson	4677
Independence	4024
Iola†	4616
Medicine Lodge	4269
Phillipsburg	5301
Salina	4969
Toronto	4582
Ulysses	5009

KENTUCKY

Alpha	3540
Bardstown	4178
Catlettsburg	4279
Farmers	4501
Frankfort	4211
Franklin	3570
Greensburg	4369
Junction City	4113
Marion	3935
Middlesboro	3853
Owensboro	4175
Paducah	3654
Richmond	4126
Scott	4785

LOUISIANA

Alexandria	1745
Amite	1492
Antioch	2164
Calhoun	2168
Cameron	1281
Cheneyville	1607
Collinston	1998
Dodson	1727
Franklin	1198
Franklinton	1484
Grand Cane	2099
Houma	1078
Melville	1471
Rayne	1268
Robeline	1997
Tallulah	2057
Tenmile	1454

MAINE

Bar Harbor	7643
Greenville†	9439
North Brighton	7600
Orono	7934
Presque Isle	9440

MARYLAND

Annapolis	4483
Cambridge	4245
Clear Spring	5522
Cumberland	5196
Emmitsburg	5230
Fallston	5261
Grantsville	6493
Princess Anne	4205
Solomons	4202
Sudlersville	4676
Takoma	4948

MASSACHUSETTS

Amherst	6894
Fitchburg†	6743
Williamstown	7225

MICHIGAN

Ann Arbor	6877
Battle Creek	6585
Bay City	7051
Cadillac	7970
Calumet	9297
Charlevoix	7689
Cheboygan	8234
Coldwater	6423
Flint	7179
Harrison	7749
Hart	7040
Houghton†	9030
Iron River	9416
Ironwood	9126
Jackson	6483
Kalamazoo	6655
Ludington†	7458
Menominee	8043
Mio	8335
Pontiac	6924
Port Austin	7361
Port Huron	7195
Saginaw	7063
St. Joseph	6203
Seney	9293

MINNESOTA

Beardsley	8490
Cass Lake	9445
Fairmont	7849
Hallock	10285
Luverne	7915
Montevideo	8169
Moorhead†	9327
Red Wing	7883
Sandy Lake Dam	9620
Thief River Falls	10044
Tower	10440
Wadena	9523

MISSISSIPPI

Austin	2753
Batesville	2905
Columbia	1739
Corinth†	3087
Crystal Springs	2013
Greenwood	2391
Holly Springs	3298
Kosciusko	2482
Leakesville	1611
Macon	2507
Nitta Yuma	2649
Palo Alto	2523
Pearlington	1329
Pecan	1346
Porterville	2104
Rosedale	2643
Shoccoe	1932
Shubuta	2140
Tupelo	2781
Woodville	1565
Yazoo City	2152

MISSOURI

Bolivar	4330
Caruthersville	3439
Chillicothe	4902
Dean	3942
Glasgow	5235
Grant City	5661
Hannibal†	5393
Hollister	3750
Jackson	4228
Jefferson City	4874
Joplin	3904
New Haven	4544
Poplar Bluff	3908
Potosi	5340
Unionville	5929
Warsaw	4353
Willow Springs	4304

MONTANA

Biddle	7786
Bowning	9400
Columbia Falls	8080
Dillon	7796
Glendive	8235
Harlowton	8781
Hebgen Dam	10945
Lewistown	8230
Livingston	7205
Malta	8892
Ovando	9452
Poplar	9241
Roundup	7512
Thompson Falls	7347
Upper Yaak River	8857
Victor	7637

NEBRASKA

Bridgeport	6830
Culbertson	5917
Drexel†	6611
Dumas	7207
Fort Robinson	7095
Halsey	6646
Hebron	5843
Hillside	6832
Kearney	6050
Kennedy	6922
Kimball	6724
Madrid	6456
St. Paul	6082
Santee	6766
Springview	6872
Stanton	6796
Tecumseh	5773

NEVADA

Belmont	7399
Beowawe	6622
McGill	6980
Quinn River R.	6673
Wells	7575

NEW HAMPSHIRE

Bethlehem	8773
Hanover	8005
Keene	7458

NEW JERSEY

Asbury Park	5272
Belvidere	5792
Bergen Point	5366
Boonton	5977
Bridgeton	4661
Burlington	5009
Cape May†	4870
Clayton	5045
Dover	6270
Elizabeth	5302
Hightstown	5360
Indian Mills	5172
Jersey City	5193
Lakewood	5399
Lambertville	5316
Long Branch	5396
Moorestown	5620
New Brunswick	5404
Newton	6135
Paterson	5365
Phillipsburg	5694
Plainfield	5535
Ridgefield	6091
Sandy Hook†	5369
Somerville	5586
South Orange	5745
Sussex	6034
Vineland	5043
Woodbine	5036

NEW MEXICO

Aragon	6158
Campana	4284
Carlsbad	2589
Chama	7946
Clovis	4197
Corona	5114
Elephant Butte	3401
Elizabethtown	9449
Fort Stanton	5069
Fort Sumner	3912
Fort Union	6231
Fort Wingate	5638
Fruitland	5438
Gage	3252
Gallinas Springs	4552
Magdalena	5218
Santa Fe†	6123
Senorito	9031

NEW YORK

Appleton	6775
Auburn	6747
Canton†	8305
Cape Vincent	7775
Cooperstown	7756
Cortland	7388
Cutchogue	5621
De Ruyter	7687
Elmira	6412
Franklinville	7455
Glens Falls	7244
Gloversville	7468
Indian Lake	8777
Ithaca†	6914
Jamestown	6740
Liberty	7676
Little Falls	7604
Lyons	6448
Middlebury	6803
Mohonk Lake	6635
Moira	8149
North Lake	8853
Number Four	8716
Ogdensburg	7688
Plattsburg	7897
Port Jervis	6388
Rome	7418
Saranac Lake	8675
Setauket	5549
South Canisteo	7200
Ticonderoga	7323
Utica	6796
Wappingers Falls	6238
Watertown	7298
Westfield	6548
West Point	5882

NORTH CAROLINA

Andrews	3603
Banners Elk	5746
Beaufort	2309
Brevard	4180
Brewers	3911
Charlotte	3120
Eagletown	3346
Hickory	3401
Hot Springs	3483
Kinston	2768
Louisburg	3518
Manteo†	3109
Marion	3604
Monroe	3153
Mount Airy	4128
Nashville*	3219
Pinehurst	2818
Pittsboro	3619
Roxboro	3842
Salisbury	3222
Southport	2199
Washington	2673

NORTH DAKOTA

Ashley	9471
Crosby	10091
Donnybrook	10006
Forman	8893
Fort Yates	8522
Grafton	10267
Grand Forks†	9871
Hannah	11018
Jamestown	9406
Manfred	9749
Mayville	9252
Minot	9581
New England	8961
Oakdale	8723
Washburn	9062
Westhope	10384

OHIO

Bangorville	5942
Bellefontaine	6036
Bowling Green	6233
Cambridge	5484
Cardington	6003
Clarington	5944
Clarksville	5231
Dover	6004
Green	4643
Greenville	5754
Hillhouse	6520
Kenton	5870
Lancaster	5272
Lima	5935
Marietta	4757
Marion	5685
Millport	6307
Montpelier	6411
New Bremen	5769
North Lewisburg	5802
Oberlin	6173
Orangeville	6465
Peebles	5088
Plattsburg	5688
Pomeroy	4828
Portsmouth	4411
Shenandoah	6343
Somerset	5314
Upper Sandusky	5804
Warren	6117
Waverly	4946

OKLAHOMA

Broken Arrow†	3826
Chattanooga	2962
Enid	3882
Hugo	2648
Kenton	4457
Keokuk Falls	3618
Muskogee	3616
Newkirk	3839
Rankin	3851
Ravia	2740
Shawnee	3240
Vinita	3681
Woodward	4008

OREGON

Corvalis	4740
Dayville	5513
Diamond	7300
Falls City	5368
Klamath Falls	6465
Lakeview	7094
McKenzie Bridge	5705
Parkdale	6553
Silver Lake	7453
Umatilla	4680

Vale	6268
Waldo	5648
Wallowa	7361
Warmspring	5687

PENNSYLVANIA

Altoona	6121
Bethlehem	5230
Bradford	6929
Canonsburg	5678
Carlisle	5710
Coatesville	5365
Corry	7190
Easton	5727
Emporium	6465
Franklin	6383
Gettysburg	5581
Gordon	6377
Greensburg	5796
Grove City	6489
Hanover	4943
Hyndman	5750
Johnstown	5539
Kennett Square	5388
Lancaster	5482
Lebanon	5585
Lewisburg	6395
Mount Pocono	7543
New Castle	5958
Pottstown	5153
State College	6297
Towanda	6540
Uniontown	5176
Vandergrift	5398
Warren	6740
Wellsboro	6893
West Chester	5441
York	5449

RHODE ISLAND

Narragansett Pier†	6397

SOUTH CAROLINA

Aiken	2311
Allendale	2107
Anderson	2732
Cheraw	2816
Dillon	2500
Due West†	2890
Ferguson	2245
Georgetown	1991
Heath Spring	2965
Newberry	2650
Paris Island	1601
Walhalla	3175
York	2725

SOUTH DAKOTA

Academy	7044
Dowling	7340
Faulkton	8260
Flandreau	8027
Forestburg	7889
Jefferson	8419
Milbank	8465
Murdo	7142
Oelrichs	7271
Pierre	7283
Pollock	8778
Spearfish	7072
Yankton	7144

TENNESSEE

Carthage	3587
Rogersville	4023
Savannah	3199
Springville	3654
Tullahoma	3717

TEXAS

Barstow	2224
Beaumont	1072
Blanco	1989
Bowie	2400
Brazoria	1008
Brownfield	3150
Childress	3045
Clarendon	3571
Claytonville	2533
Dalhart	4881
Dennison	2533
Eagle Pass	871
Fort Clark	1374
Fort Davis	2650
Fort Lancaster	2030
Fort McIntosh	730
Haskell	2552
Hereford	4186
Knickerbocker	1959
Lampasas	1974
Liberty	1101
Lieb	4393
Marshall	1923
Midland	2594
02 Ranch	2160
Panter	2169
Plainview	3332
Rock Island	1297
San Augustine	1758
Sierra Blanca	2128
Somerville	1450
Sonora	2091
Spur	3196
Taylor†	1909

UTAH

Black Rock	6438
Cedar City	5679
East Portal	11129
Emery	7071
Escalante	6193
Green River	5674
Ibapah	7569
Kelton	6696
Levan	6885
Logan	6748
Manila	8454
Modena†	6598
Ogden	5538
St. George	3756

VERMONT

Enosburg Falls	8388
Northfield†	8804
Wells	8037

VIRGINIA

Alexandria	4572
Big Stone Gap	4626
Birdsnest	3753
Blacksburg	4977
Bristol	4509
Callaville	3758
Charlottesville	4223
Columbia	4210
Culpeper	4606
Danville	3511
Fortress Monroe	3552
Fredericksburg	4242
Hampton	3092
Hopewell	3663
Ivanhoe	5132
Newport News	3483
Quantico	4894
Runnymede	3599
Salem	3789
Saxe	3904
Staunton	4448
Warsaw	4308
Williamsburg	3675
Winchester	4784
Woodstock	4804
Wytheville†	5103

WASHINGTON

Aberdeen	5586
Anacortes	5632
Bellingham	5417
Blaine	6122
Brewster	6396
Buckley	5574
Centralia	5201
Clearwater	5701
Colfax	6411
Cusick	7323
Davis Ranch	6295
Ephrata	5551
Everett	5941
Glacier	6959
Kiona	4974
Lake Kachess	7689
Longmires Sprgs.	7646
Lyle	5375
Northport	7170
Oroville	6126
Port Townsend	5510
Puyallup	5431
Sedro Woolley	5404
Sixprong	5062
Stehekin	6679
Union City	5313
Vancouver	4748
Wenatchee	6555
Zindel	4308

WEST VIRGINIA

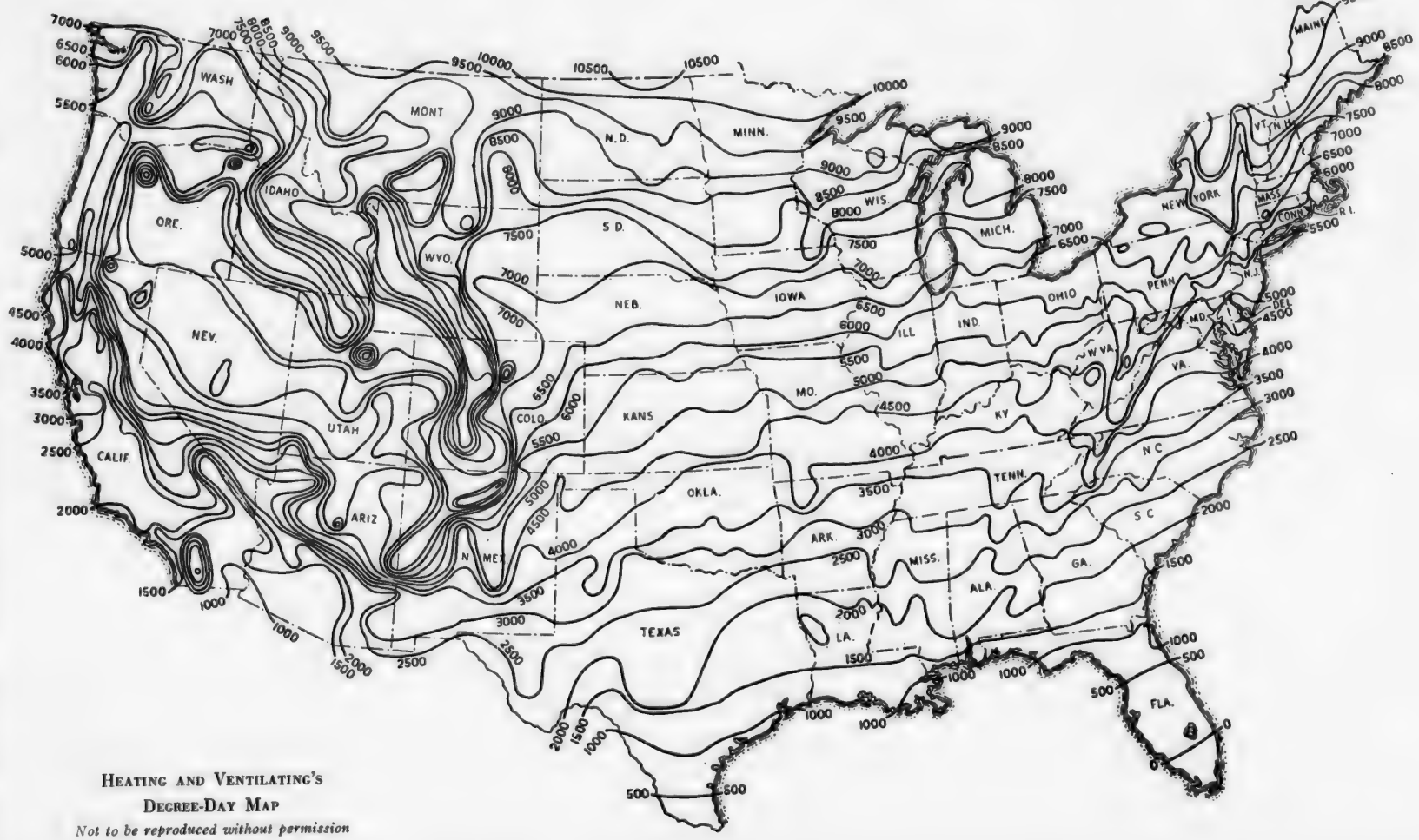
Bayard	6488
Cairo	4642
Elkhorn	4411
Fairmont	5047
Green Sulphur Spgs.	5087
Lost Creek	5179
Marlinton	6220
Morgantown	5095
New Cumberland	5664
New Martinsville	4778
Point Pleasant	4516
Sutton	4590
Upper Tract	5032
Wheeling	5218
White Sulphur Spgs.	5122
Williamson	4242

WISCONSIN

Appleton	7705
Beloit	6876
Crandon	8978
Darlington	7420
Deerskin Dam	9784
Downing	8643
Eau Claire	7970
Florence	9115
Fond du Lac	7617
Iron River	9195
Kewaunee	7957
Manitowoc	7730
Medford	8564
Oshkosh	7508
Park Falls	9459
Racine	6763
Reedsburg	7277
Rest Lake	9425
Sheboygan	7382
Spooner	8760
Sturgeon Bay	8201
Superior	9750
Tomahawk	8659
Valley Junction	7917
Waupaca	7892
Wausau†	8494
Whitehall	7850
Wisconsin Rapids	8028

WYOMING

Cody	7771
Cokeville	10020
Colony	7793
Daniel	11118
Dome Lake	11614
Ervay	8626
Gillette	7518
Green River	8255
Griggs	7521
Kinnear	8114
Newcastle	7426
Pathfinder	7402
Saratoga	8630
Snake River	11111
South Pass City	11101
Worland	8058
Yellowstone Park†	9605



HEATING AND VENTILATING'S
DEGREE-DAY MAP

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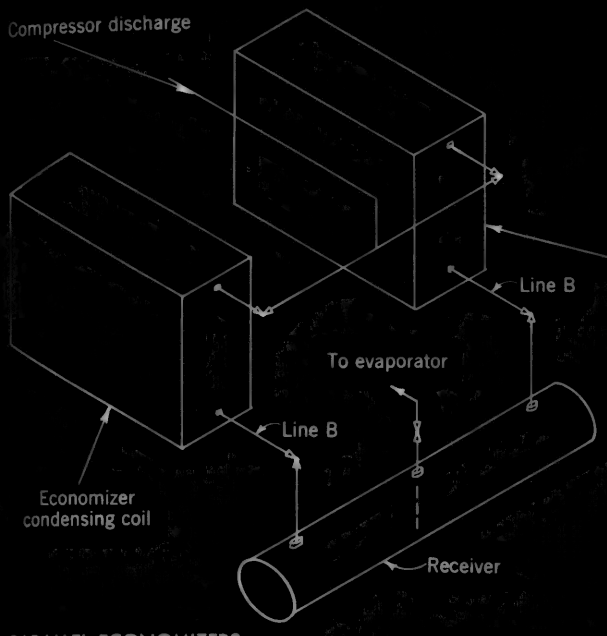
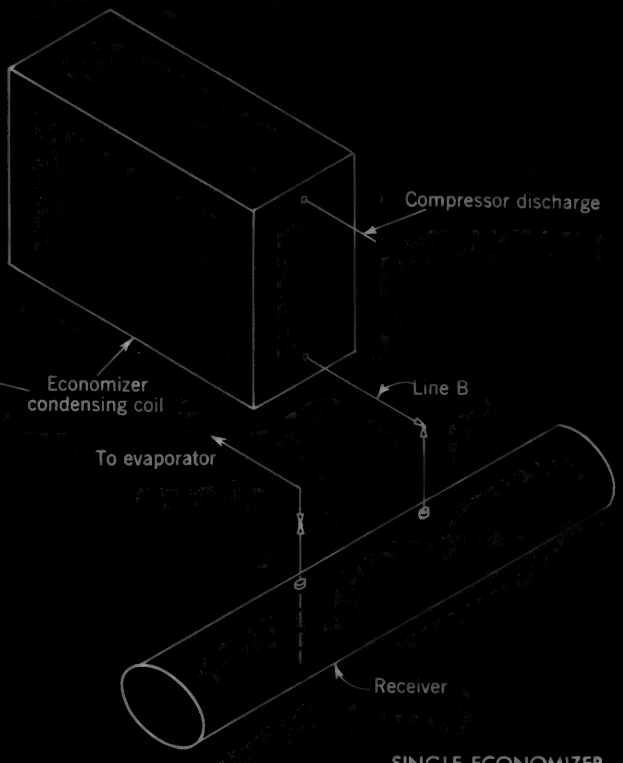
HIGH PRESSURE FREON-12 RECEIVERS

HORIZONTAL AND VERTICAL

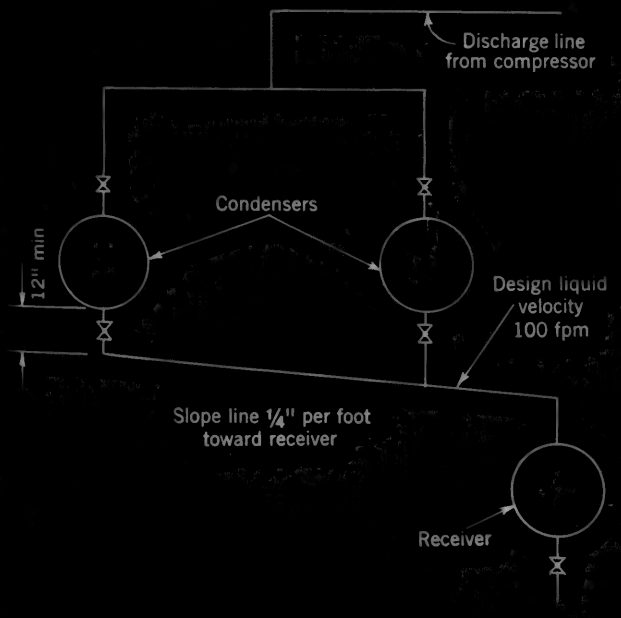


PARALLEL ECONOMIZERS AND RECEIVER ARRANGEMENT



SINGLE ECONOMIZER AND RECEIVER ARRANGEMENT

Note: Slope line B ¼" per foot or more, and size for 100 fpm velocity at maximum tons

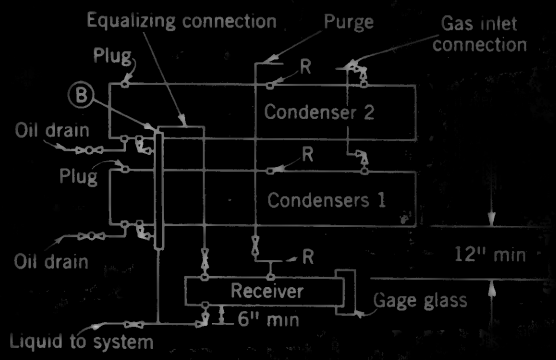


PARELLEL CONDENSERS AND ONE RECEIVER

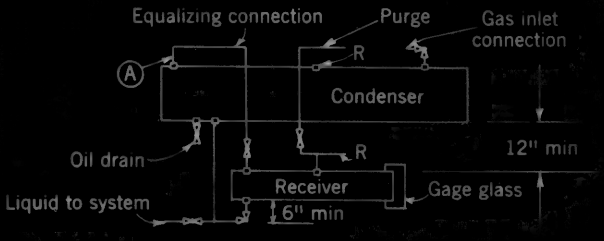
CONDENSERS WITH SURGE RECEIVER

Note positions of equalizing connections (A) (B)
R-relief (when required)

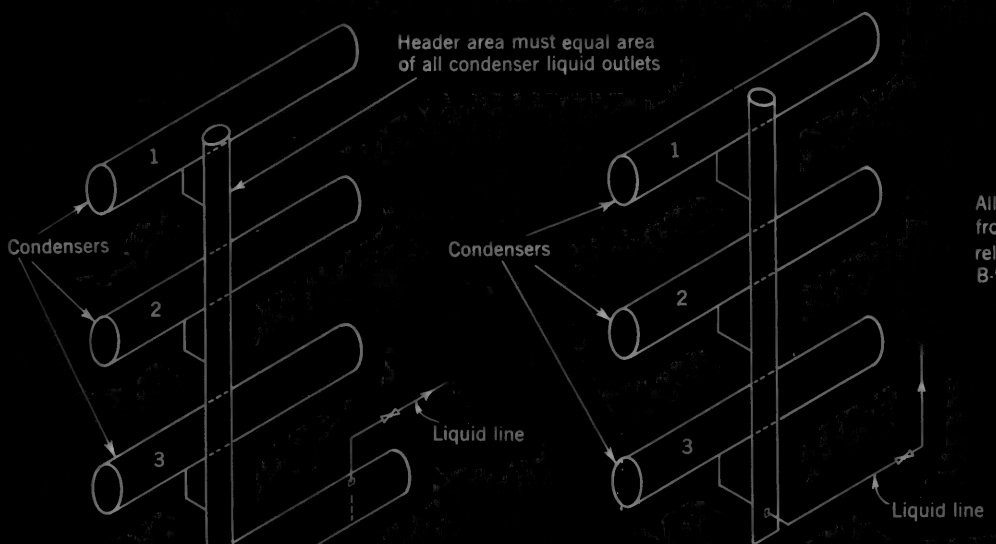
TWO OR MORE CONDENSERS



ONE CONDENSER



HIGH PRESSURE FREON-12 RECEIVERS
HORIZONTAL AND VERTICAL



All receivers should be protected from excessive pressure by a relief valve according to ASA B-9 or local codes.

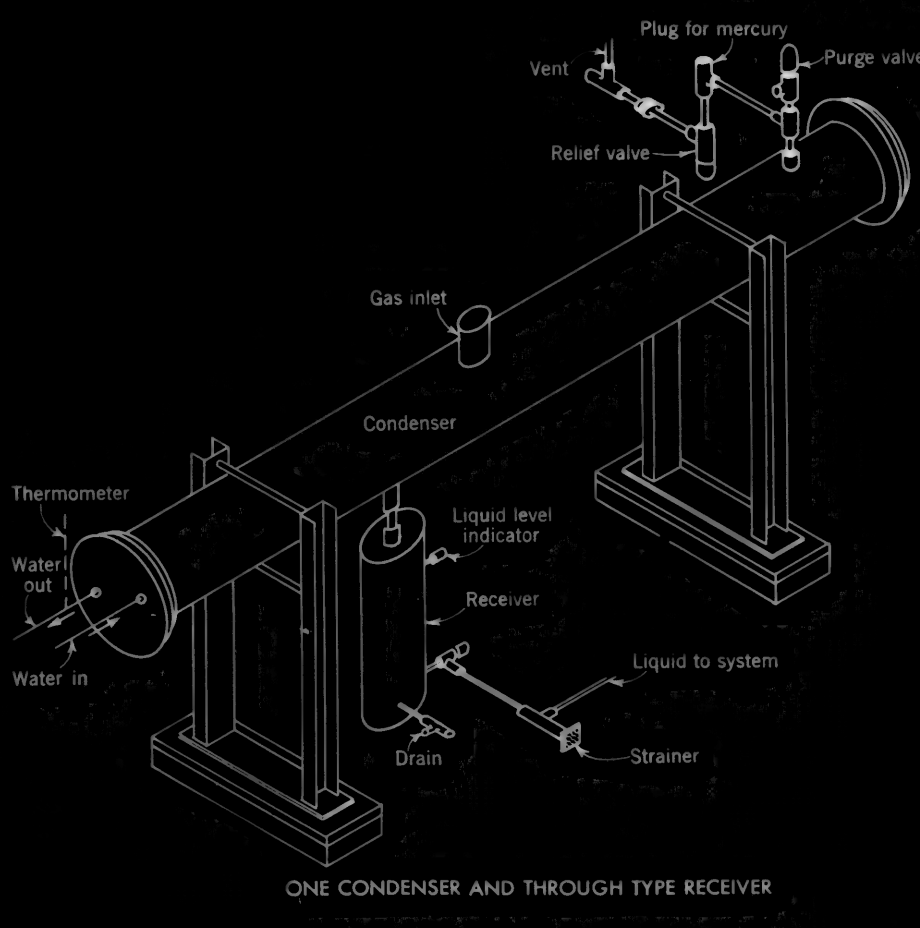
RIGHT

CONDENSERS IN PARALLEL VERTICALLY

WRONG

(Because liquid is trapped in condenser No.3)

PIPING HOOKUPS THROUGH THE COOPERATION OF YORK CORP. YORK, PA



ONE CONDENSER AND THROUGH TYPE RECEIVER

Heat Pump Moves Forward

A group of papers relating to various aspects of the heat pump was presented at the Winter General Meeting of the American Institute of Electrical Engineers held in New York City. This article consists of abstracts of these papers.

FOR some time the American Institute of Electrical Engineers has been interested in heat pump developments, and as part of its winter meetings, has held a special session devoted to this subject.

This year, as part of its Winter General Meeting, a heat pump session was held on January 20 at the Hotel Statler, New York City. A group of three papers was presented as follows: Performance of an Earth Source Heat Pump, by Dr. Merl Baker, The Kentucky Research Foundation, Lexington, Ky.; Advancement in the Weathertron Program, by P. F. O'Neill, General Electric Co., Bloomfield, N. J.; The Residential Heat Pump, by J. L. Ditzler and F. R. Benedict, Westinghouse Electric Corp., Hyde Park, Mass. C. D Graham, General Motors Corp., Dayton, Ohio, discussed these papers and reviewed some of the developments in this field.

In the early days of heat pump development, there seemed to be some confusion as to what constituted the best source of heat—earth, water or air. While one source might show a better constant and dependable supply of heat, installation costs were so high that the economic balance was not too favorable. At present, there seems to be a strong leaning toward the use of air, even though there is a dropping of air temperature in winter at a time when heating demand is greatest. Earth and dependable water sources provide more stable conditions.

Following are abstracts of the papers and a discussion presented at this heat pump meeting.

The Residential Heat Pump

J. L. DITZLER AND F. R. BENEDICT

Westinghouse Electric Corp., Hyde Park, Mass.

THE trend in small air conditioning units up to 25 hp (about 25 tons) is toward packaged units. The advantage to the user is quite obvious. Smaller sizes are applicable to homes and industry and we are today witnessing a tremendous expansion in air conditioning for home comfort.

Getting something for nothing appeals to all but such offers usually have some form of hidden conditions attached. The objective of the heat pump system is to obtain free a high proportion of the total system heat from earth heat or heat from the air. The ratio of the amount of energy delivered in a heat pump to the energy expended in the form of motive power is called the coefficient of performance. This ratio increases as the temperature difference between the heat absorption sources decrease.

Coefficient of performance versus outside temperature (Fig. 1) for the ideal heat pump shows that this ratio reaches values of 25 when the outside temperature approaches 50F. The approach to this ideal coefficient, however, has been far below the ideal as shown by the actual experience curve. The approach to the ideal is much better at low outside temperature than at the higher values. It indicates that cost and size limit the present performance to the values shown since the designs are selected for temperatures in the vicinity of 20F outside temperature. The value of this ideal coefficient, of course, can vary from a low value of 1 to an infinite value when the outside temperature equals the inside temperature.

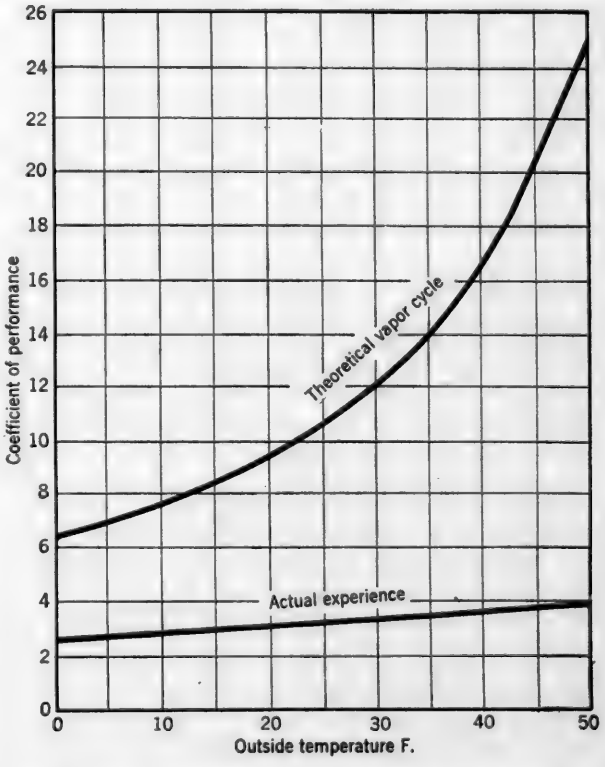


Fig. 1. Theoretical and actual coefficient of performance.

In our work on the heat pump we decided very early that we would develop a unit which used air as the heat source. The fact that air is free, universally available, and simple to put to use, overshadowed the disadvantages of uneven temperature and low specific heat.

It seemed to offer the least troublesome source for the home owner from a service standpoint. It offered less corrosion problems and seemed to provide the lowest installation cost. While it might be possible to provide cheaper equipment using water as a source of heat, the added installation cost would more than overcome this advantage when compared with air.

The most pressing problem which must be solved before an economically priced heat pump system can be provided, is a solution to the high cost of installation. To overcome this, it was decided that a factory-built assembly, of all of the components necessary in the refrigeration system would provide the most economical solution. (See the cover photograph).

Our work on heat pumps started back about 1934-35, not too long after our entry into the air conditioning field, with an installation in a home in Reading. It stimulated interest in the possibilities of the heat pump, an interest which has motivated development and has brought us to our present status.

Window Unit Introduced

In this same year we took another step. We marketed a line of air-to-air window type air conditioners known as Mobilaires. With the addition of a four-way valve it was decided that this unit would make an excellent heat pump. After intensive development, production was started in 1941. This ½ hp heat pump window unit was, to the best of our knowledge, the first package heat pump on the market. The reversal was not automatic, but was accomplished by turning a hand valve to the heating and cooling positions as required. Unfortunately for everyone, this unit was just beginning to show its value when in late 1942 it became a war casualty and production ceased.

To have a simple, automatic cycle and one which could be changed from heating to cooling, automatically, it was necessary to do considerable work on the refrigerant cycle. The conventional refrigeration cycle uses a compressor, condenser, evaporator and a means for controlling the refrigerant flow through these elements, usually an expansion valve. To reverse the flow of refrigerant through such a system, a four-way valve is needed for reversing the inlet and outlet flow to the condenser and evaporator. Also since the flow through conventional expansion valves cannot be reversed, a second expansion valve has to be provided and a check valve for each expansion valve to control refrigerant flow in both directions.

This form of system, even though conventional, seemed too complicated and was simplified. By using a small tube known as a capillary or restrictor, the expansion valve can be omitted. Such capillaries are now used, with few exceptions, on refrigerators and window type air conditioners. Advantages of the restrictor are simplicity, low cost and elimination of two check valves. The disadvantage of a restrictor tube is that its resistance to flow is constant and the system may demand a variable resistance. This disadvantage is overcome by proper system proportions and design.

The heat pump system is thus simplified and reversal is now accomplished by a single automatically operated four-way valve. The valve is pressure operated by means of a small solenoid controlling high pressure gas to an operating piston.

A system also had to be developed for controlling the time at which the outdoor coil is defrosted. When the outdoor temperature drops to the point where the coil operates at or below freezing temperature, ice forms on the surface of the coil and affects performance. The condition becomes worse when high relative humidities are encountered.

Defrost Cycle

The defrost operation is initiated by means of a differential pressure switch which measures the pressure drop of the air across the outdoor coil. Whenever frost forms on the outdoor coil, the pressure increases due to restrictions in the air passages. As soon as the restriction reaches a pre-determined value, the differential pressure switch reverses the operation of the heat pump and causes it to operate as a cooling unit. This then changes the outdoor coil to a condenser, which quickly melts all of the ice.

In this unit, the time of melting of the ice is determined by the point at which the discharge pressure reaches a pre-determined value. When the unit operation is reversed, the outdoor coil becomes a condenser and this coil is at freezing temperature. Under this condition, the pressure of the refrigerant in the coil will be in the neighborhood of 20 psi. As the ice is melted the coil warms up and the pressure increases; when all of the ice has melted, the coil operates as an air-cooled condenser, at pressures in excess of 150 psig. As this pressure is approached the unit again reverses automatically and operates as a heating unit. The defrost cycle requires approximately three minutes for its completion.

Packaged units of 3 and 5 hp have been developed which include all essential equipment, except ductwork, to provide a heating and cooling system. Space occupied by the compressor becomes almost insignificant as compressor designs are improved with increases in speed.

Problems for Added Study

There are many problems attendant to residential heat pump application that warrant intensive study by engineers.

(1) The maximum economy will be realized only if the home is designed for heat pump application. Heat gain and heat loss should be critically examined in the construction of the house.

(2) The heat pump should be of the correct size for the house. Sizing must be accurate and based on the most reliable data obtainable; it is important that data applicable to the actual location be used.

(3) The heat pump must have the correct electrical system. This includes power availability, proper entrance equipment and proper installation wiring. The heat pump requirements must also be integrated with the other home electrical requirements.

(4) Developments leading to a higher coefficient of

performance will reduce the electrical demand. The potential in this direction warrants intensive scientific attention. Development of satisfactory low cost heat storage media would greatly improve the average coefficient.

(5) Homes have a large amount of waste heat generated in them through television sets, home lighting, electric and gas cooking and hot water heaters. While this aids the heating cycle, it is additional load on the air conditioning cycle and ways should be studied to economically relieve the cycle of this loss.

Performance of an Earth Source Heat Pump

MERL BAKER

The Kentucky Research Foundation, Lexington, Ky.

INCREASED demand for summer air conditioning has given new impetus to development of the heat pump. The present lines of research are predominantly concerned with improving means for transferring heat to and from available reservoirs, cycle efficiency and equipment. The ultimate goal is to produce a heat pump that can satisfactorily air condition a building during both winter and summer with lower cost of operation and installation. Although three types of heat reservoirs are available, this discusses the use of an earth reservoir.

Feasibility of Earth Reservoirs

Earth heat exchangers may be used in rural and city residential areas, but not in downtown or other congested places. Almost all city lots in residential areas are sufficiently large to accommodate the ground coil length required. In almost all cases, as the size of the house and air conditioning requirements become greater, larger lots are available. Different coil arrangements can be used to meet simultaneously the load demand and fit into the ground space available. Obviously, in a block containing large buildings, the use of an earth coil would be impractical. With the exception of an isolated resort hotel or manufacturing plant, the earth reservoir is limited to residential application and accordingly remarks are directed to this application.

In central and northern climates, where heating is the design criterion rather than cooling, the burial depth of coil should be selected to give an undisturbed soil temperature of approximately 40 to 45F. This temperature occurs at approximately 6 ft for the 0 F design zone. This depth could profitably be increased slightly for colder zones and decreased substantially for warmer ones.

A temperature difference is required to drive heat from the surrounding soil to the buried coil, and consequently with an undisturbed soil temperature at the value recommended, the evaporator temperature of the heat pump may be kept reasonably high. The temperature differential required is dependent on the rate of absorption per foot of pipe length, together with the nature of the soil and moisture content.

As heat pump capacity, as well as efficiency, is a function of evaporator temperature, the length of coil required must be balanced with the compressor. Insufficient coil length produces an abnormally low evaporator temperature while an excessively long one results in better efficiency and greater capacity but at the expense of increased first cost.

It is desirable that the coil temperature for design conditions does not fall below 20F. A moist soil may be expected to deliver heat, under the conditions discussed, at a rate from 40 to 50 Btu per hour per foot of length for periods of short duration and an average from 20 to 30 over the entire season.

As the average seasonal load is approximately one-third the design load, it is evident that the coil may be satisfactorily sized on the higher rates to meet the design load.

As moisture is driven away from the heated coil during summer operation, thermal conductivity is less and coil effectiveness is reduced. A greater temperature differential between the coil and undisturbed soil is permissible thereby allowing approximately the same dissipation rate per foot of pipe as for winter operation. As more heat per unit of time must be discharged during summer operation, a greater coil length will be required. In central and northern latitudes, the full capacity of a plant sized for heating will not be needed for cooling and if the capacity can be reduced during the cooling period, the coil will be more than adequate. This would not be true for southern areas. A reasonably small diameter tube will transfer nearly as much heat as a reasonably large one. Coils may be placed reasonably close together without important reductions in effectiveness with a separation of 2.5 ft being satisfactory.

Initial Cost

Basic components of heat pumps utilizing any of the available heat reservoirs are nearly the same including, compressor units, air conditioning coils, air handling equipment, refrigerant receiver, expansion valve, reversing valve and auxiliaries.

The chief difference occurs in the heat exchanger between the reservoir and refrigerant. A coil buried in the earth may serve as a direct heat exchanger in which case it must be of adequate construction to restrain the refrigerant. This would usually necessitate the use of copper, aluminum or steel tubes with all joints welded or secured with hard solder. An intermediate heat exchanger could be employed to exchange heat between the refrigerant and an antifreeze solution.

The antifreeze solution would be heated or cooled by being circulated through the ground coil. This arrangement introduces an added heat exchanger and a loss in efficiency because of the additional temperature differential required, however, practical and economical ad-

TABLE 1.—MAXIMUM ELECTRIC RATE ALLOWING COMPETITIVE OPERATION OF HEAT PUMP WITH COMBUSTIBLE FUELS

Fuel	Fuel Cost	Equivalent Electrical Rate, Cents per kwh
Natural gas	$.06 per 100 cu ft	.009
Coal	$12.50 per ton	.010
Fuel oil	$.15 per gal	.017

vantages are achieved. The buried coil may be plastic tubing. The flexible tubing may be located in channels dug into the ground as narrow as two or three inches, and all joints made at an accessible hub.

The power consumption of a heat pump is dependent on the temperature difference between the two heat exchangers. A high evaporator temperature and low condenser temperature are highly desirable, but not always possible. The outside heat reservoir dictates the possible evaporator temperature for winter and minimum condenser temperature for summer. The temperature maintained within the building regulates the operating conditions of the air conditioning heat exchanger.

An earth reservoir heat pump should operate with a heating energy ratio of 3.0 or better, meaning that the cost of operating the heat pump is one-third or less of that possible with resistance heaters. Table 1 demonstrates the power rate necessary to compete with conventional fuels.

An installation designed by the author in a house with a volume of 16,000 cu ft and a heat loss of 48,000 Btu per hour (70F inside and –5F outside) and located in Hopkinsville, Ky., was studied during the winter of 1950-51. Performance data during the 1950-51 heating season of 4,327 degree days reveal that the house was heated by 3,628 kwh electrical consumption and that operation was satisfactory at a minimum outside temperature of –22F.

Advancement in Program

P. F. O'NEILL

General Electric Co., Bloomfield, N. J.

THIS paper is a report on the heat pump activities of one manufacturer. On August 1, 1953 the General Electric Company announced that henceforth the name for its air-to-air heat pump would be The Weathertron. This unit, with the front panel removed, is shown in Fig. 2. The various components are visible.

In entering the heat pump business, we did not toss it out to all areas like a Yo-Yo. You might say, we restricted

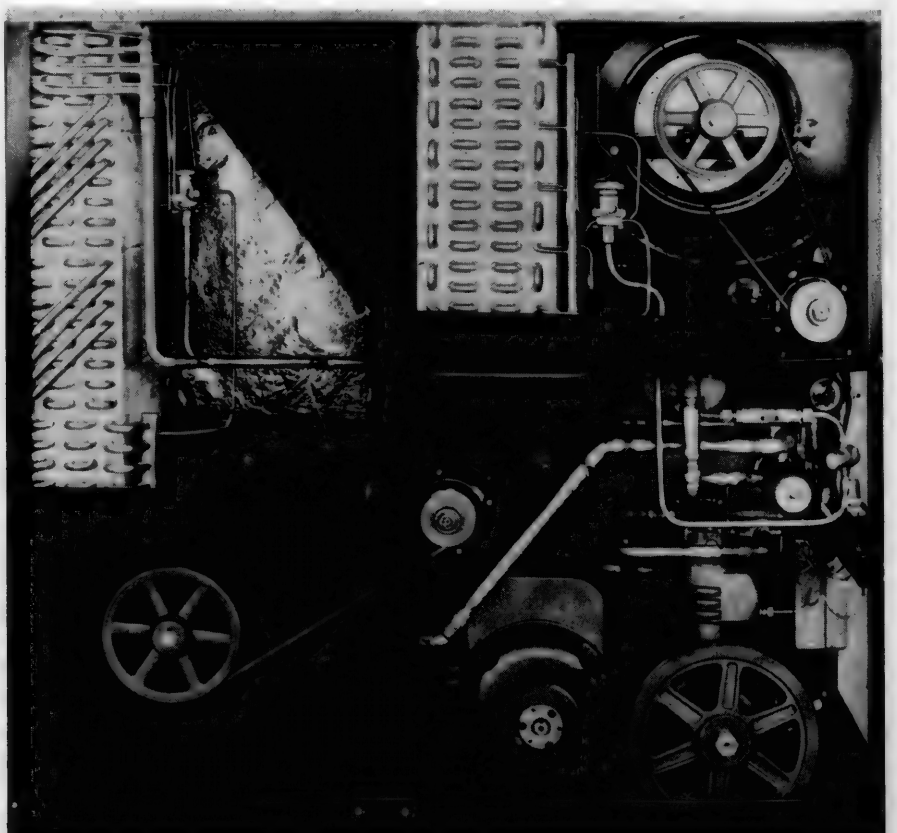


Fig. 2. View of a heat pump with the front part of panel removed. Various mechanical parts of unit, as well as the piping and valves, are shown.

it to areas where residential summer cooling was now becoming a "must" and heating was required. We did not go out and franchise all of our outlets at the same time. Instead, we examined the ability of each account to apply, service, and sell the product. Such an approach requires time, but it is one way in which to insure good residential sales outlets together with proper application know-how and proper service facilities.

Many people are of the opinion that we are in the southern areas because the heating requirements of the homes are less than those in the northern regions. This may be news to many of you but homes in the south can have a greater heat loss per cubic foot than those of the same size in the northern areas. Insulation of the crawl space and outside walls as well as storm windows or double glass are unthought-of items in construction in many southern areas.

Since the heating capacity of the heat pump system must be given proper consideration, the product is applied to what we call "well insulated homes". This does not mean storm windows or double glass in all areas of the south, but it does mean that in many areas where crawl spaces and side wall insulation is generally overlooked, our dealers can make a good application by specifying such insulation.

Heating design temperatures in the south vary over a wide range of values. For example, Amarillo, Tex., has 0F design; Dallas, Tex., 13F design; Miami, Fla., 35F; Atlanta, Ga., 12F; Chattanooga, Tenn., 9F, etc. Therefore, applications of the product go hand-in-hand with well insulated homes for the area.

In entering this business we emphasized the fact that we were definitely interested in the residential market. This is the area where the greatest potential for electric load building programs rests.

As we see it, the installation of a heat pump system in a home should act as a magnet attracting only electric appliances. There is no reason for other service facilities such as gas and oil. Therefore, the installation of a heat pump system should act as an insurance not only for the sale of 10,000 to 15,000 kwh or more for heating and cooling, but it should also result in the sale of about 6,000 kwh as used by the other electric equipment in the all-electric home.

Heat pump sales to date have not only been for new homes and existing homes, but a number have also been installed in new and existing commercial buildings. Commercial installations have been made in banks, drug stores, diners, dress shops, radio stations, TV studios, furniture stores, doctors' clinics, motels and other businesses. Multiple installations using two or more units are not uncommon in the commercial field.

Residential applications vary from single 3 hp installations to multiple installations of two and three units.

Discussion on Residential Heat Pump Development

C. D. GRAHAM

General Motors Co., Dayton, Ohio

UPON examining the good and bad features of each of the three major types of systems (air to air, water to air, and ground to air), it should be evident that no one of the three is all good or all bad. From the manufacturer's viewpoint, I believe that the air-to-air system, which lends itself to a factory sealed package, looks the most attractive. From the viewpoint of the user or the utility company, the type of system preferred will probably vary depending upon climate and local conditions. Where the winters are mild, air-to-air would get their vote. Where the winters are more severe, probably they would favor the ground coil. Where water is cheap and abundant, the water heat source should not be overlooked.

This brings us to the idea of a universal type unit that could be used with air, water or ground as a heat source. Such a unit would consist of the compressors, receivers, fans and coils for the house circuit and all major controls both refrigerant and electrical. Where air is to be the heat source, an air coil and fan assembly could be mounted at any convenient location (adjacent or remote) and the refrigerant lines run between the two packages. For water systems, it is essentially the same procedure, install the water heat exchanger at any convenient location and connect the refrigerant lines. For a ground coil system then the step is merely to connect the ground coils.

We have built several such units. One is a 6 hp (twin 3 hp) with one system reversible and the other not. The reason for this arrangement is that the cooling load on the home in which it is installed can be handled by 3 hp, but 6 hp is required for the peak heating demand. The unit that is not reversible handles the first stage of heating. The reversible system comes on to help out in severe weather. This equalizes the wear on the two systems as one compressor operates whenever heat is required, and the other compressor runs only in severe winter weather or when cooling is required. This system is connected to ground coils.

Another unit has the same general arrangement but is 8 hp (3 hp-5 hp combination) with the 5 hp system reversible. Still another unit is for a water system in the south where the full 8 hp is required for cooling and heating, so both compressors are reversible.

A unit of this type can have its major components factory assembled and tested. It is not, however, a factory sealed system, so some field supervision at the time of installation is advisable.

Whether an air-to-air sealed unit or a universal type unit such described, or some other design that is still just a gleam in some engineer's eye, will prove the best answer to residential heat pumps, I do not know. But on this point I am certain: We, as engineers (whether we be consultants, utilities men or designers) must find the proper answers, make the proper compromises, and bring forth the proper design or designs that will give the customer satisfactory service at a first cost and operating cost he is willing to pay.

What Would You Do?

Replies to engineering and operating problems of interest to the industrial plant engineer

Conducted by
NATHAN N. WOLPERT
Associate Editor

VENTILATION problems in industrial plants are quite common, whether they are the result of grinding or sanding operation, or whether they follow a hot dip cleaning process.

The current problem regarding the slot width for a hood used over a hot dip cleaning operation, resulted in some valuable comment.

Should you have a problem that you would like to see treated in this department, or if you have some comments that you would like to contribute concerning the problem scheduled for the next issue, you are invited to write to the Editor. Such letters are always welcome.

This Month's Problem

The reply to this question is based on the accompanying set of curves developed by Benjamin F. Postman, industrial hygiene engineer, Employers Mutual Liability Insurance Company, New York, N. Y.

Here is the Problem

We have a ventilation problem. Fumes given off from a tank during a hot dip cleaning operation, are not properly handled by the hood which draws in the air at the rear of the tank, along the long side. The tank is 7 ft long by 3 ft wide and we use an air velocity of approximately 2,000 fpm. What should the slot width be? If we increase the velocity to 2,500 fpm, then what would the slot width be?

A tank 7 x 3 ft has an area of 21 sq ft. Assume that there is 200 cfm per square foot of tank surface.

Then 21 $\times$ 200 cfm = 4,200 cfm to be exhausted from this tank. Using the set of curves for 2,000 fpm which is the group at the left of Fig. 1, we proceed as follows to find the answer:

Find 4,200 cfm on the chart and proceed horizontally, as indicated by the dotted line until it meets with the vertical line for a 7 ft slot. The intersecting point indicates that the slot should be 3½ inches wide, if the air travels at a velocity of 2,000 fpm.

For a design, using 2,500 fpm air, use the middle set of curves of the chart. Then where the 4,200 horizontal line meets with the vertical line for the 7 ft slot, we find that the hood should have a 3-inch slot.

The statement of the problem lacks five essential pieces of information: How hot is the bath? What chemicals are in the bath? What metal is being dipped? What are the room drafts at the tank location? And, is the tank free standing or backed up against a wall or another ventilated tank?

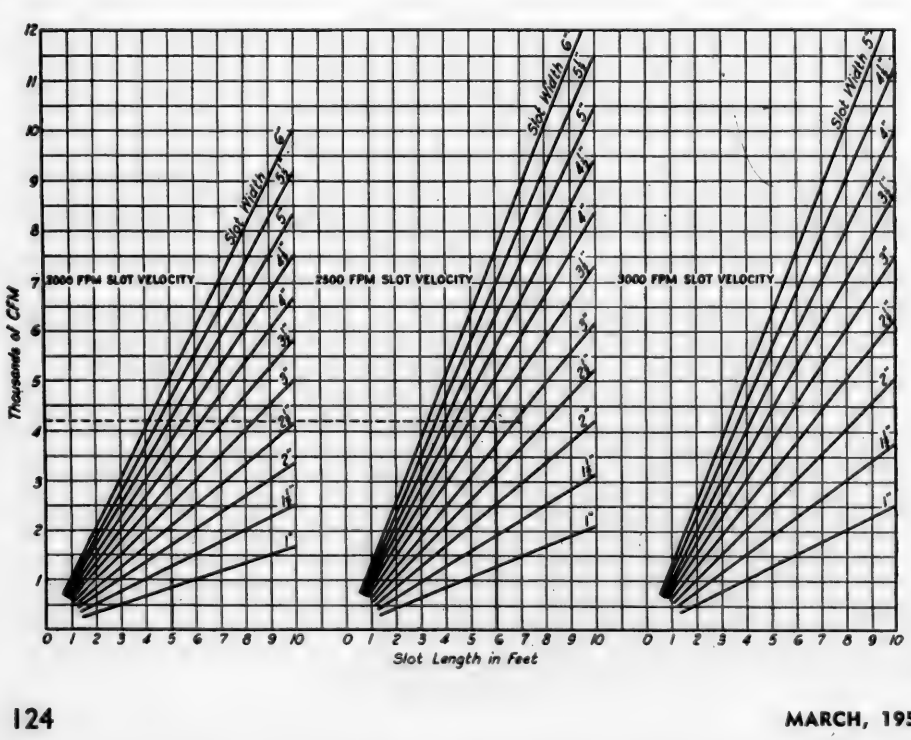


Fig. 1. Chart developed by Benjamin F. Postman for determining size of slot for various slot velocities.

TABLE 1—VENTILATION OF 7 FT X 3 FT HOT DIP CLEANING TANK (ASSUMING NO ADVERSE ROOM DRAFTS)*

Bath		Tank Temperature		Tank Location		Control Velocity	Ventilation Rate	Ventilation	Slot Height in Inches	
Caustic	Non Caustic	150-200F	Over 200F[1]	Against Wall[2]	Free Standing	Lateral Exhaust, FPM	CFM/ Sq Ft	CFM	2,000 FPM	2,500 FPM
	X	X		X		50	75	1575	1¼	1⅛
	X	X			X	50	100	2100	1¾	1⅜
	X		X	X		75	110	2310	2	1⅝
X		X		X		75	110	2310	2	1⅝
	X		X		X	75	150	3150	2¾	2⅛
X		X			X	75	150	3150	2¾	2⅛
X			X	X		100	150	3150	2¾	2⅛
X			X		X	100	200	4200	3⅝	2⅞

*In the event of adverse room drafts increase control velocity, ventilation rate, ventilation and slot height in proportion to estimate of draft intensity.
[1]Includes aluminum in caustic bath of over 150F.
[2]Includes tank backed up to another ventilated tank.

A determination of how much air should be exhausted from the tank depends upon a knowledge of all five factors. Lacking this data, this problem has been solved to show the range of ventilation rates recommended for various assumptions as to these variables using the methods of solving these problems outlined in the American Standard Safety Code for Ventilation and Operation of Open-Surface Tanks (ASA-Z9.1-1951).

Table 1 shows that the quantity required to be ventilated varies from 1,575 cfm to 4,200 cfm for draft-free locations depending upon the location and operation of the particular tank. For drafty locations, more air would be needed to control the mist and steam evolved. The slot heights required for 2,000 and 2,500 fpm slot velocity are shown in the last two columns of the table.

Arthur C. Stern,
Div. of Industrial Hygiene Chief Engineer,
N. Y. State Department of Labor
New York, N. Y.

There is not sufficient information to give an exact answer to the question of controlling the fumes from the hot dip cleaning tank. Not knowing the solution or temperatures involved, I will assume that it is caustic and the temperature is below 212F.

It appears that the person asking this question is more interested in slot velocity than the proper air volumes. Actually, it is the volume of air which gives control and the slot velocity usually only gives distribution the length of the slot. I usually use the 2,000 fpm slot velocity mentioned in the question which will give proper distribution if the slot is properly designed. The air volume for conditions stated would then be 200 cu ft per square foot of tank or a total of 4,200 cfm. Using the 2,000 fpm slot velocity, this would figure out to require a slot of 3.6 inches in width. This quantity of air could be reduced by 20 per cent if a baffle extended upward from the top of the slot to prevent air from being drawn from behind the hood or if the manifold is extended upward to serve as a baffle.

For more detailed information, I would refer the reader to Chapter 4 and also to pages 5, 37, 38 and 39 of the Industrial Ventilation Manual as published by the American Conference of Governmental Industrial Hygienists, Lansing, Mich.

K. E. Robinson,
Ventilation Engineer, Industrial Hygiene Dept., Research Laboratories Division, General Motors Corp.
Detroit, Mich.

It is difficult to offer specific suggestions for your problem without more details relative to the exact type and quantity of air contamination involved.

In general, however, it is poor ventilation design to use lateral exhaust along only one side of a tank if the quantity of air required to provide a satisfactory control velocity at the unventilated side of the tank becomes prohibitively large. It would be preferable from the standpoint of operating efficiency to provide lateral exhaust to each of the long sides of this tank. If this were done, air volumes ranging from 90 to 260 cfm per square foot of tank surface will be required to properly control most hazardous materials. The exact value required will be determined by the specific type of material to be controlled. Based upon this range of air capacity and the size of the tank, the slot width required to maintain an air velocity of 2,000 fpm will range from 0.8 to 2.25 inches.

I suggest as a source of reference for the individual presenting the problem, the American Standard Z9.1-1951, entitled Ventilation and Operating of Open Surface

Problem for the Coming Issue

A 30-ton evaporative condenser installed adjacent to the compressor on the ground floor of a multi-story building, proved too small for peak summer air conditioning loads. Because of the expense and space limitations, we do not want to replace the present unit with a larger one. We propose to install a shell and tube condenser cooled by city water for the remaining 7 tons required to handle the full load. This would be placed between the evaporative condenser and the receiver. Is this proposed system practical or can this idea be improved? If such an arrangement is not recommended, why?

Tanks, as published by the American Standards Association.

W. E. McCormick
Dept. of Industrial Hygiene and Toxicology
The B. F. Goodrich Company
Akron, Ohio

Generally the slot along the edge of a tank is made one or two inches wide. If a one inch width is used, the velocity may be approximately 2,000 fpm, or if a two-inch width is used, 1,000 fpm. The former arrangement tends better to equalize the flow into the plenum or duct. There is no disadvantage in a high slot velocity if the connecting duct is laid out to give continuous

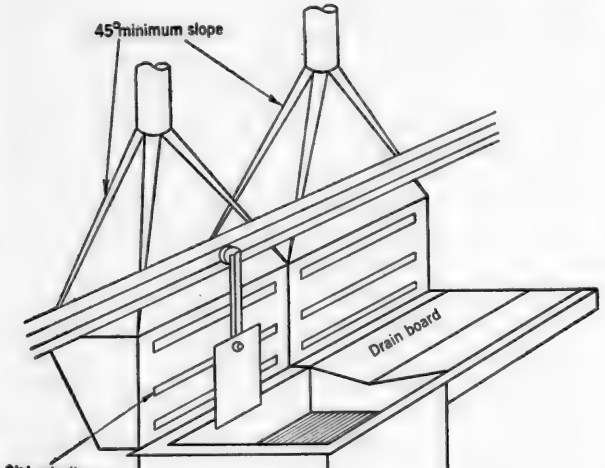


Fig. 2. Hood design for dip tank.

acceleration of the air up to the duct velocity. Higher velocity through the slot into the plenum is a waste of power unless it must be used to obtain uniform distribution.

Fig. 2 shows what I would do in the way of a hood for the hot dip tank described in your problem for current discussion. This is based on 100 cfm per square foot of tank area or drain board. Duct velocity is 1,500 to 2,000 fpm. The entry loss equals 1.78 slot velocity pressure plus 0.25 duct velocity pressure.

This formula is included in a manual of recommended practice issued by the Committee on Industrial Ventilation, American Conference of Government Industrial Hygienists.

Harold E. Wilson
Draftsman
National Carbon Company
Div. of U. C. & C. Corp.
Fremont, Ohio

It is difficult to tell from the statement of the problem, all of the conditions that are involved in this plant's difficulty with its dip cleaning tank, so it may be best to consider the basic factors involved in designing effective ventilation for open surface tanks. For such effective ventilation, the primary considerations are:

(1) Sufficient exhaust air volume to control the water vapor and contaminant rising from the surface of the tank.
(2) Proper hood design to create a uniform air flow across all portions of the tank surface.

To accomplish this, the proper exhaust air volume is determined from the type of contaminant, rate of emission, and cross drafts or other disturbances across the surface of the tank.

In practice the engineer usually refers to published values of exhaust rates which combine all of these into a figure of quantity of air required, that is, cubic feet per minute per square foot of tank area. Effective hood design depends upon the degree of taper in the hood itself to provide distribution and also a slot velocity in the range of 1,000 to 2,000 fpm for the hood. The slot area is obtained by dividing the quantity of air to be exhausted by the design slot velocity.

When higher slot velocities than these are used, ventilation control is not greatly improved although distribution across the hood face may be made more uniform. This is done, however, at the expense of fan horsepower since the loss through the slot increases with the square of the velocity. As an example, the slot loss at 2,000 fpm slot velocity is approximately 0.70 inch of water while the loss at 2,500 fpm is approximately 1.10 inches of water. This results, therefore, in an increase of ⅜ of an inch static pressure which the exhaust fan must overcome. In the case given, the increase in slot velocity from 2,000 to 2,500 fpm will give 25 per cent more exhaust air assuming the same slot area, but this will be done at a cost of increased fan horsepower due to this increased loss at the slot. This slot loss is in addition to the normal increase in duct work losses with the higher air volume.

It may be better for the plant to maintain the same slot velocity of 2,000 fpm and increase the total air volume by a corresponding increase in the size of the exhaust slot. This is of course providing that the present fan is capable of exhausting the increased air volume.

As an example, assuming that the tank involved is a typical alkali cleaning tank, the total exhaust rate should be as follows:

Solution not boiling, 250 cfm per square foot of tank, 5,250 cfm total.

Solution not boiling, 200 cfm per square foot of tank, 4,200 cfm total.

Assuming a slot velocity of 2,000 fpm, the proper slot areas would be 2.6 square feet in the first case and 2.1 square feet in the second case. With one or more slots 7 feet long, the widths of the slots may be varied to obtain these areas.

This information on the subject of open surface tank ventilation may be obtained from the Industrial Ventilation Manual which is published by the American Conference of Governmental Industrial Hygienists. Copies of the manual can be obtained by writing to the Committee on Industrial Ventilation, P. O. Box 453, Lansing, Mich.

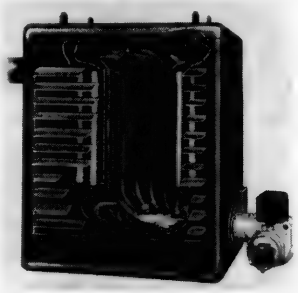
James C. Barrett
Ventilation Engineer
Division of Occupational Health
Michigan Department of Health
Lansing, Mich.

NEWS OF EQUIPMENT AND MATERIALS

Use the prepaid postcard opposite page 151 for securing additional information on items described in this department.

Oil-Fired Unit Heater

A direct-fired oil unit heater that is completely self-contained and can be used as a humidifier or air circulator is a development of Delta Heating Corp., Trenton, N. J. It uses commercial No. 2 oil, but can be operated with gas by removing the oil burner and inserting the company's completely assembled Inshot gas burner unit. The burner can be mounted on either side of the stainless steel combustion chamber.



The heater is easily moved about to meet plant changes. It suspends overhead, but can be bolted to a portable platform or dolly for heating temporary buildings or spot locations. Multiple unit installations of from 3 to 30 units are possible. Oil is fed to the heaters through a reservoir pipe line of from ¾ to 2 inches (depending upon the number of units) after being raised from an underground oil tank by an Autopulse wall pump with a 25 foot lift.

Unit output is 220,000 Btu per hour and input is 2 gal of oil per hour. A 24 inch, four blade fan is powered by a ½ hp 115-230 v. single phase motor. Capacity is 5730 cfm, and effective air throw is 50 ft. Adjustable louvers direct heated air to where heat is needed; the unit is thermostatically controlled.

Weighing 390 lb, the heater is 49½ inches high, 39 inches wide, and 21 inches deep.

More information? Circle Item 1 on postcard, page 151

Grille Conceals Air Conditioner

The outside appearance of any room air conditioner can be improved by the Decor room conditioner grille, manufactured by Bar-Brook Mfg. Co., Shreveport, La.

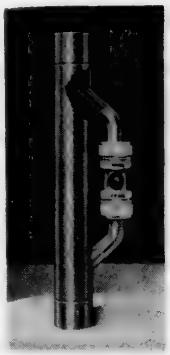
Easily attached to wood, brick or masonry, it conceals the room conditioner without interfering with its efficiency.

The grille is light-weight, all-aluminum construction, finished in semi-gloss outside white only, but can be repainted to harmonize with any color scheme, and quickly removed for painting or servicing. The unit is made in four sizes.

More information? Circle Item 2 on postfard, page 151

Liquid Flow Indicator

A liquid flow indicator, the Flo-Free E-Z-See, developed by Remco, Inc., Zelienopole, Pa., permits positive refrigerant flow at all refrigerated pressures.



Because of the shunting arrangement of the indicator itself, there is no measurable line pressure drop. At the same time, the sensitive indicator flap in the tubular glass viewing window permits analysis of the functioning of the expansion valve. The flow-responsive flap responds instantly and clearly to all variations and interruption of flow.

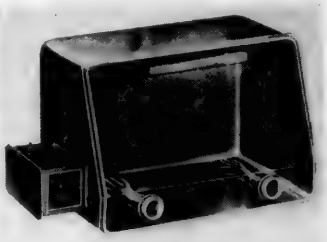
The distance from the sweat connections to the gaskets is so great that disassembly for silver soldering is not required. For the convenience of those who prefer to disassemble or have occasion to make replacement, swivel nuts are used to attach the indicator assembly to the 45 deg elbows.

Viewing windows are double-port, and tubular high-pressure pyrex glass assures safety, even up to 500 psi. The units come in ⅞ and 1⅛ inch sizes.

More information? Circle Item 3 on postcard, page 151

Controlled Atmosphere Hood

A lightweight, portable controlled atmosphere hood is made available by P. M. Lennard Co., Inc., Brooklyn, N. Y. It creates a dry, sterile, inert and dust free atmosphere, governing germs, mold, moisture, radioisotopes and other contaminated materials and conditions. It is constructed of a chemically inert fiber-glass plastic material.



A filter system with vacuum or pump allows the operator to select purification trains to control dust, bacteria and moisture either individually or together. When necessary, hands or objects may be put in and removed freely without loss of internal pressures or control conditions.

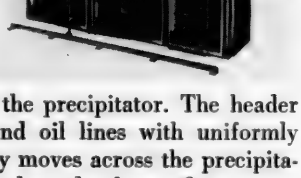
The hood is useful in the radioactive field because alpha and beta particles of higher energies and gamma photons of lower energies can be safely handled and completely controlled. The hood allows for the insertion of any required thickness of lead sheeting between the laminated layers to provide the necessary radiation shield against gamma photons of energies higher than 100 millicuries.

Factory produced, the hood can be readily equipped with specialized attachments which are standard, such as sterilizer ultra-violet lamps, filter controls, vacuum pumps, and neoprene gloves. The standard hood is 36 inches long, 20 inches deep and 24 inches high.

More information? Circle Item 4 on postcard, page 151

Washer for Precipitator

The Electro-Cell electronic precipitator, redesigned to provide semi-automatic reconditioning of the collector plates, is a development of American Air Filter Co., Inc., Louisville, Ky. The recently developed type H washer washes the collector plates with water sprays and recoats them with a dust holding adhesive. The operation is automatic after a starting button is pushed.



The washer consists of a vertical header attached to a carriage that travels on an overhead trackway extending the full width of the precipitator. The header comprises separate water and oil lines with uniformly spaced nozzles. The assembly moves across the precipitator twice on the washing cycle and, after a five minute drying period, sprays the collector plates with adhesive.

The flat spray nozzles are placed at a 5 deg. angle to the vertical plane of the collector plates thus insuring thorough penetration of the plate assembly. The washer is optional equipment available for all sizes larger than 6 ft. high by 6 ft. wide.

Bulletin 252-E3 is issued free on request.

More information? Circle Item 5 on postcard, page 151

Detects Ammonia Leaks

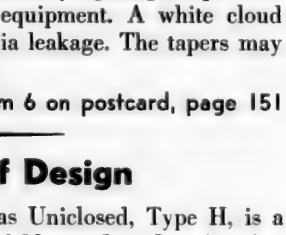
A pocket-size device for detecting ammonia leaks is announced by Allied Chemical & Dye Corp., New York, N. Y. It consists of Sulfstix, or long, sulphur-impregnated tapers in a container designed to be carried in a pocket or hung on the wall near ammonia equipment.

Ammonia leaks can be detected by lighting a taper and holding it near the suspect equipment. A white cloud indicates the point of ammonia leakage. The tapers may be extinguished and reused.

More information? Circle Item 6 on postcard, page 151

Motor of Dripproof Design

A new motor, designated as Uniclosed, Type H, is a development of U. S. Electrical Motors Inc., Los Angeles, Calif. One outstanding feature is its drip-proof design which offers splashproof protection without increased cost. The frame is solid, one-piece cast iron and the stator is prewound. Frame sizes 182-184 are available.



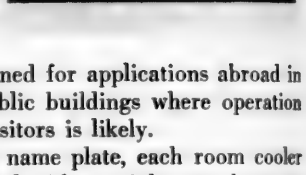
By utilizing the interior space to better advantage, the motor is built more compactly so that the same horsepower can be embodied in less space. The end brackets have air intakes so arranged as to prevent intrusion of water, yet allow liberal air flow into the motor for 2-way ventilation. Baffles within the air vestibules of the end brackets prevent splashings from entering and coming in contact with the windings.

This motor in its various sizes meets the same standards as its former type in temperature rise, and torque. Overload capacity has not been reduced. The slot design of the laminations has been improved and the asbestos-protected windings are reinforced and strengthened. A split dome, cast iron terminal box makes the leads more accessible.

More information? Circle Item 7 on postcard, page 151

Cooler Designed for Export

A room air conditioner that cools and heats in three languages is introduced for the export market by United States Air Conditioning Corp., Minneapolis, Minn. The company's 1954 units for foreign use carry as standard equipment a name plate which provides complete instructions for operation in English, French and Spanish.



The innovation is designed for applications abroad in hotels and other quasi-public buildings where operation of the units by foreign visitors is likely.

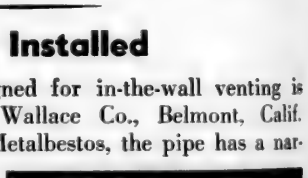
In addition to the new name plate, each room cooler for export will be furnished with an eight-page hang-tag instruction booklet, also in three languages.

The conditioners have complete Fiberglas cabinet construction, for lighter weight and resistance to corrosion and denting. The design also features an interior cabinet which extends into the average room less than two inches. All units include heating as standard equipment.

More information? Circle Item 8 on postcard, page 151

Gas Vent Easily Installed

A gas vent pipe designed for in-the-wall venting is announced by William Wallace Co., Belmont, Calif. Called WV (wall vent) Metalbestos, the pipe has a narrow, oval cross-section permitting easy installation inside a wall without extensive special construction or extra insulation.



The pipe features an inner and outer pipe separated by an insulating air space. A new Fastloc coupler enables pipe sections to be joined without cement or mastic, and without screws except where the vent will be left exposed in rooms or attics.

The outer pipe is galvanized steel which lessens the chance of accidentally damaging the vent during handling and installation. Aluminum is used for the inner pipe to provide a fast-heating inner hot stack and to give maximum corrosion resistance.

More information? Circle Item 9 on postcard, page 151

Lightweight Pipe Insulation

A lightweight, one-piece pipe insulation, Mono-Kover, is introduced by Baldwin-Hill Co., Trenton, N. J. It is composed of incombustible, moisture-resistant, mineral-wool fibers, bonded with phenolic resin and molded into 6 ft. long, one-piece sections.

Mineral wool fibers in this pipe insulation are inorganic, cannot decompose, and will resist most acids and alkalis. It is resilient and flexible, does not chip, splinter or crumble, yet it can be cut with a knife. The insulation has a smooth surface; it can be handled with bare hands and is easily manipulated because of its light weight.

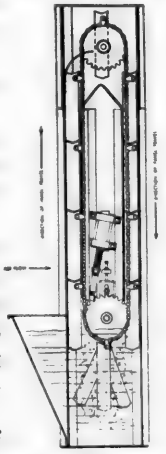
The insulation is intended for application on standard sizes of pipe for temperatures up to 350 degrees F. Molded to fit the pipe, it slips on easily, the seam is pressed together and any standard type of fastening is applied. The material may be painted for appearance and to conform with surroundings.

A catalog of this new product is published by the company.

More information? Circle Item 10 on postcard, page 151

Self-Cleaning Air-Filter

An automatic self-cleaning impingement type air filter, the Automaze, is offered by Air-Maze Corp., Cleveland, Ohio. It operates on the viscous impingement principle of air filtering, whereby air-borne particles are trapped on adhesive coated panels carried on an endless roller chain actuated by an electric time-cycle control system; an air-driven piston; and a one-way, over-riding clutch.



Intermittent action of the air cylinder agitates the panels as they are submerged in an adhesive bath, cleaning the panels and renewing the viscous material.

The panels are attached to the roller chain like a ferris wheel car. Fixed at one end, they maintain the same vertical position as they make the cycle, always presenting the same face to the moving air stream while forming a double filtering barrier.

Panels forming the filtering curtain of the air filter are constructed of many layers of crimped galvanized steel wire screens of selected meshes, precisely arranged to form a progressively denser media from the air inlet face to the air outlet face. The filter media are furnished in different designs to meet the varying filtering problems encountered in the field. The panels fit snugly in V-shaped upper and lower enclosing channels, thus preventing the bypass of dirty air between adjacent filter panels.

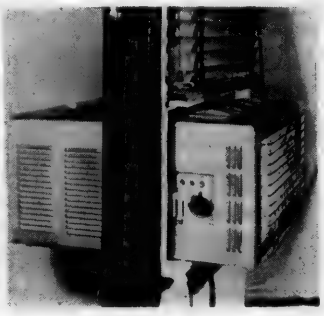
This air filter may be obtained for practically any desired capacity above 3100 cfm by bolting one or more sections together and by varying the heights of the sections. Since each filter section contains its own drive mechanism, no extra space consuming additions are needed in a multiple installation to house motors and gear boxes.

More information? Circle Item 11 on postcard, page 151

Radiant Heat in Room Cooler

An air-conditioning unit with a glass radiant heat panel is introduced by Electriglas Corp., Bergenfield, N. J.

Twin-Features, a dual-purpose unit, for wall mounting or window insertion, has a 2 sq ft, 15 lb, electrothermal glass panel covering the unit's face. Protected by a decorative grille, the panel attains a maximum temperature of 440 degrees F. with a consumption of 1500 watts.



The air-conditioner utilizes a ¾-ton hermetically sealed Tecumseh compressor. The compressor and the panel, operating on 120 volts, 60-cycle AC, are controlled by a series of three switches and a thermostat mounted on one side of the unit. Switches control the ventilating, air conditioning and heating actions.

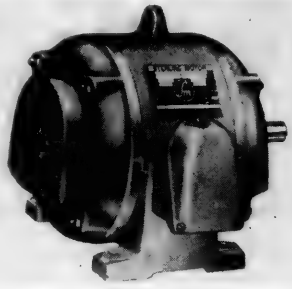
Decorated in a hammered silver finish, the unit is 26 inches wide, 15 inches high, and projects into the room 9½ inches.

Among the many uses for the unit are installation in a room added to a house or in an area lacking heating facilities, and as a stand-by for sudden temperature dips or rises in months when weather is variable.

More information? Circle Item 12 on postcard, page 151

Motors Made More Compact

A line of smaller motors, incorporating NEMA approved standards that specify more horsepower from the space occupied, is announced by Sterling Motors, Inc., Los Angeles, Calif. More than 50% of the inactive space in previous designs is eliminated.



Diagonal cover type terminal boxes may be rotated 360 deg. They have a tapped hole for the conduit.

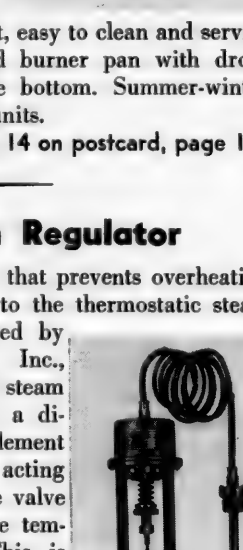
A moisture resistant labyrinth seal on the pulley end as well as fan-cooled designs protect open motors. A plug seals the short end bearings.

Improved insulation provides electrical and mechanical strength to stator windings. Windings are protected with a heat-resistant baked varnish and a moisture-resistant sealer.

More information? Circle Item 13 on postcard, page 151

Light Weight Gas Unit Heater

A line of suspended gas unit heaters, compact and light in weight, is offered by Peerless Mfg. Corp., Louisville, Ky. Built in ten models, from 60,000 to 200,000 Btu per hour, each model is available with either propeller type or centrifugal blower.

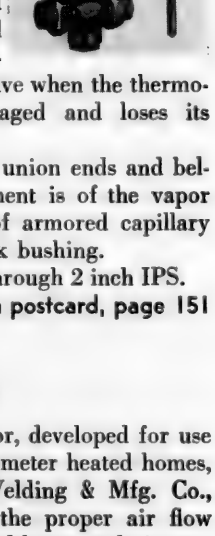


The heaters are built of auto body steel, die formed and finished in a baked-on silver-tan. The manifold and burners are a compact unit, easy to clean and service because of swing-away hinged burner pan with drop-away inspection panel on the bottom. Summer-winter switches are available for all units.

More information? Circle Item 14 on postcard, page 151

Safety Type Steam Regulator

A self closing safety feature that prevents overheating in case of accidental damage to the thermostatic steam regulator element is introduced by Lawler Automatic Controls, Inc., Mount Vernon, N. Y. The SFS steam regulator automatically closes a direct acting valve when the element accidentally fails. A reverse acting model automatically opens the valve to prevent an override of the temperature being controlled. This is made possible by the installation of a special thermostatic element and temperature adjustment, designed and constructed to close a direct acting valve or open a reverse acting valve when the thermostatic element is accidentally damaged and loses its charge.



The regulator has a bronze body, union ends and bellows bracket. The thermostatic element is of the vapor tension type and comes with 6 ft of armored capillary tubing, copper thermo bulb and tank bushing.

The valves are available from ½ through 2 inch IPS.

More information? Circle Item 15 on postcard, page 151

Air Conditioning Door

A 1⅜ inch steel flush interior door, developed for use in centrally air conditioned and perimeter heated homes, is announced by The American Welding & Mfg. Co., Warren, Ohio. Designed to allow the proper air flow between connecting rooms as required by central air conditioning installations, the Amweld air conditioning door permits closed-door privacy without impairing or disturbing the heat balance of the system and eliminates the need for return air ducts.

Of the same construction as the company's standard 1⅜ inch doors, this new air conditioning door is used with the company's standard 1⅜ inch frames and features a factory-installed grille. Sizes of the doors range from 2 ft x 6 ft 8 inches to 3 ft x 6 ft 8 inches, and sizes of the grilles from 89 to 136 sq inches.

Roll-formed of 18-gauge steel, door stiles provide ⅛ inch bevel in 2 inches on edges, which are reinforced for hinges and locks. Reinforcements are welded in place. Panels are of 20 gage cold-rolled, prime-quality sheet, roll-formed and stiffened mechanically for flatness and rigidity.

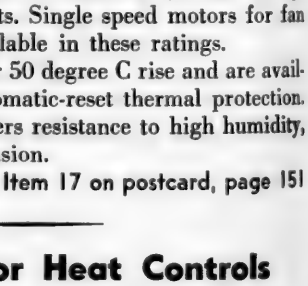
Panels are reinforced by a 24-gage, U-shaped transverse section, located every 8½ inches on opposite panels. Doors are finished at top and bottom with steel channels welded to stiles and panels.

An emulsion-type coating applied to the inside of the panels, provides sound-deadening qualities. It is resistant to heat, flame, vermin, moisture and mildew. Exterior surfaces are finished with baked-on neutral color prime coat.

More information? Circle Item 16 on postcard, page 151

Motors for Cooling Fans

A line of two-speed fractional horsepower motors for summer-cooling applications is announced by General Electric Co., Schenectady, N. Y. They are designed for use on evaporative-cooler, attic, air-circulating, and window fans, the motors being small, lightweight, with resilient bases, and mountable in any position.



The line of motors is made up of split-phase and capacitor-start types with speeds of 1725/1140 rpm. The split-phase models are rated at 1/6, ¼, and 1/3 hp, 115 volts, 60 cycles. The capacitor-start models are rated at ½ and ¾ hp, 60 cycles, 115 or 230 volts. Single speed motors for fan applications are also available in these ratings.

All motors are rated for 50 degree C rise and are available with or without automatic-reset thermal protection. Their blue-gray finish offers resistance to high humidity, heat-cold shock, and abrasion.

More information? Circle Item 17 on postcard, page 151

Color Change for Heat Controls

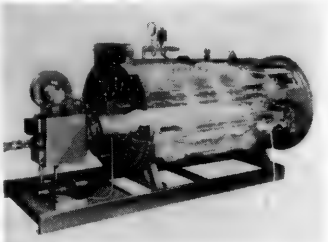
Gray finish on all damper motors, relays, furnace controls, oil-burner regulators, and other devices formerly supplied only with black covers, is an innovation by Minneapolis-Honeywell Regulator Co., Minneapolis, Minn. The change follows the company's development of its Round thermostat that features a cover that can be removed and painted to harmonize with the color scheme of any room.

Gray as a background affords greater visibility of controls and panels, according to the company. Instruments will be available in either a gray wrinkle or flat finish.

More information? Circle Item 18 on postcard, page 151

125 Hp. Scotch-Marine Boiler

A self-contained, fully automatic scotch-marine boiler, the Steamboilerplant, capable of producing 125 hp without pushing, is announced by Eclipse Fuel Engineering Co., Rockford, Ill. For commercial and industrial heating and processing applications, the boiler has automatic controls for all operating requirements.



Equipment includes a boiler shell, with extra-large furnace, mounted on a rigid steel platform, flue gas collector, burner, air blower with direct connected motor, motorized gas valve or oil solenoid valve, air and fuel ratio adjuster, gas pressure regulator or zero gas governor, gas cocks, gas pilot with solenoid valve and spark ignitor, ignition transformer, low water fuel cut-off with water level control switch, electronic flame failure protection, pressure switch, water column, pop safety valve, steam gage, try cocks, and water gage. Completely assembled, the new boiler is ready for immediate operation after electricity, steam, water, fuel and stack are connected. All necessary wiring is complete.

Features of the boiler are its larger steam space, combustion area, water storage area, and heating surface. The boiler burns gas, gas or light oil, gas or heavy oil, oil only and heavy oil only (requiring preheat).

More information? Circle Item 19 on postcard, page 151

Insulating Building Block

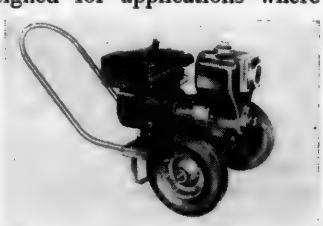
A new lightweight, all-ceramic building block which possesses many advantages over the common cement block has been developed by Armour Research Foundation, Illinois Institute of Technology, Chicago, Ill.

The new block, which is entirely ceramic and contains no portland cement, is 90% bloated clay, bonded with fused clay. It is a standard size, 8 x 8 x 16 inches, three-cavity block. It is highly insulative, and has a conductivity of 0.3 Btu or less per square foot of wall area per hour.

More information? Circle Item 20 on postcard, page 151

Pumps for Water Drainage

A line of self-priming contractors'-type centrifugal pumps, built to handle muddy or unclear water, is in production at Jacuzzi Bros., Inc., Richmond, Calif. These heavy-duty units are designed for applications where rapid movement of large volumes of water is desired. They are suited for use by building contractors for de-watering excavations and quarries.



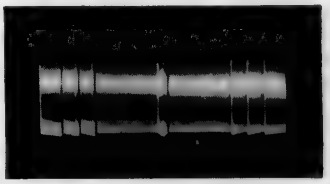
The design features a balanced type of priming port which prevents loss of capacity due to re-circulation of water. Semi-open impellers are non-clogging with adjustable clearance to compensate for wear, and a renewable impeller wear plate prevents wear on the impeller case itself. A separate opening in top of the case permits easy priming without need for extra fittings or disturbance of piping. These pumps are rated for continuous duty as well as for intermittent service.

The pumps are made in a wide range of horsepower ratings with choice of electric motor, gasoline engine or heavy-duty transmission head for belt drive. For greater ease in handling on job sites, the pumps may also be ordered (as illustrated) with a light weight, two-wheel hand trailer on ball bearing type wheels and semi-pneumatic tires.

More information? Circle Item 21 on postcard, page 151

Coupling Plastic Pipe

Con-X-All coupling, a plastic-to-plastic fitting for coupling plastic pipe, is available from American Sanitary Mfg. Co., Abingdon, Ill. The coupling is precision-machined from solid brass, and is designed so that plastic pipe is held securely and will not leak or pull off once the hose clamp is applied.



Couplings are available in ½, ¾, 1 and 1¼ inches.

This coupling is a sister product of the company's fittings for adapting plastic to brass and plastic to copper. With these three fittings, the manufacturer can now offer fittings for every plastic pipe connection.

More information? Circle Item 22 on postcard, page 151

New Heat Exchanger Design

A heat exchanger of unlimited long life has been introduced in the new Dura-tube winter air conditioner by Surface Combustion Corp., Janitrol Div., Columbus, Ohio. The Dura-tube exchanger employs a process developed by the National Bureau of Standards during World War II to protect military aircraft from destructive high temperatures.

The resulting heat exchanger, used in all 1954 deluxe model Janitrol furnaces, is more durable than either cast iron or steel which have been used exclusively for many years. The new exchanger has virtually an unlimited life expectancy.

The AGA has rated the Dura-tube type heat exchanger to withstand a normal heating temperature of 1100 deg. as compared with a rating of 875 deg. for cast iron or steel units. The unit maximum temperature, however, is kept below 800 deg.

More information? Circle Item 23 on postcard, page 151

Exhauster and Blower

Two industrial type fans, corrosion resistant and adapted to the removal of fumes from plating operations, are introduced by Chicago Blower Corp., Franklin Park, Ill. Type LV (left) is a large volume exhauster available in four sizes with a forward curved wheel of all welded construction. Type PB (right) is a pressure blower utilizing a radial bladed wheel of aluminum alloy. Both models are furnished with self-aligning, grease lubricating pillow blocks, but bronze sleeve-type bearings are optional at no extra cost.

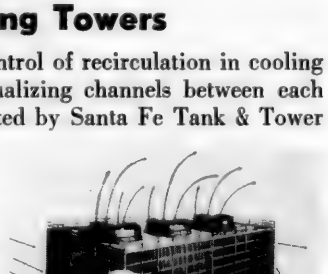
The fans are supplied with integral polyphase motors of rigid ball bearing type.

Type LV handles volumes up to 2124 cfm and pressures to 1½ sp, while Type PB handles volumes up to 335 cfm and pressures to 4 inches sp. Both types are furnished for 90 degree adjustment as to position of discharge.

More information? Circle Item 24 on postcard, page 151

Design for Cooling Towers

Progress toward the control of recirculation in cooling towers by the use of equalizing channels between each cell of the tower is reported by Santa Fe Tank & Tower Co., Los Angeles, Calif. The channels are introduced into large, multicell towers, equalizing pressure on both sides of the tower by permitting air to pass completely through the tower. The differential pressure set up by strong winds is thereby avoided.



The degree of recirculation always determines the tower's performance. However, this factor cannot be accurately predicted in advance of actual operation, for recirculation will vary with every type of cooling tower installation.

Location or obstructions in the vicinity of the company's tower will not impede its performance; the equalizing channels will, under all atmospheric conditions, balance pressure and reduce recirculation.

More information? Circle Item 25 on postcard, page 151

Ductless Highboy Conditioner

A new ductless highboy air conditioner, which can also be used for heating, is placed in production by Union Asbestos and Rubber Co., Chicago, Ill.

Available in models ranging from two to 15 hp (including twin units providing 10 and 15 ton capacities), the unit has air-acoustic insulation throughout the cabinet to prevent condensation and insure quiet operation.

Designed to provide economical and efficient air conditioning for small stores, shops, offices and other types of commercial installations, the Unarco highboy may also be equipped with a steam or hot water heating coil for use as a heater in winter. Addition of the coil adds five inches to the height of the unit.

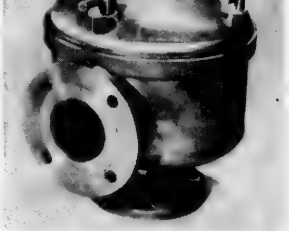
An unusual feature is the fact that it is constructed in three sections. This enables the unit to be carried in passenger elevators or transported in van type trucks in an upright position.

A reversible plenum chamber can be removed, if desired, and the unit connected to ducts.

More information? Circle Item 26 on postcard, page 151

Multiple Surface Filters

Compact, large capacity filters with filter areas up to 720 square feet and cake space capacity up to 35 cf are being marketed by Micro Metallic Corp., Glen Cove, N. Y. These filters are recommended for clarification service and solids collection with water, petroleum products and molten metals.



The filter medium is high temperature resistant, porous, stainless steel and the container can be either carbon steel or stainless steel for corrosive service. The filter medium prevents breakthrough point, or pressure above which clarity of filtrate is no longer obtained, and it will not pass filter-aid during any portion of the filtration cycle.

The compact design permits steam jacketing, high pressure construction, sanitary construction, and ease of cleaning.

More information? Circle Item 27 on postcard, page 151

Steam Reducing Valve

A pilot-operated steam reducing valve is announced by Klipfel Valves, Inc., Hamilton, Ohio. The valve, designated as No. 933, meets the needs of most steam reducing valve installations.

Although extremely sensitive, its operation is simple. Downstream pressure is sensed by the diaphragm of the pilot valve. The pilot uses upstream pressure to open the main valve if downstream pressure is too low; if too high, it bleeds off the pressure, allowing the main valve to close as required. The action is accomplished without appreciable variation in downstream pressure because correction is made almost instantaneously when the pilot valve senses any slight change in controlled pressure.

The valve is manufactured in sizes from ¾ to 6 inches. Sizes below 2 inches have bronze bodies; larger sizes are semi-steel. Stainless steel discs and seats are used in sizes 4 inch and smaller; 5 and 6 inch sizes are supplied with bronze inner valves and seats, but can be furnished with stainless trim on special order.

More information? Circle Item 28 on postcard, page 151

Temperature Indicator

Sensitivity and rapid response in temperatures measurements are provided by the Climate-Survey temperature indicators of Beckman and Whitley, Inc., San Carlos, Calif. The basic instrument is available in three models. Model 196 has six overlapping ranges spanning from −70 to +60 F; Model 197, six overlapping ranges spanning from 10 to 140 F; and Model 198, has a single range from 60 to 90 F.

All are battery-operated for portability and provide 500 hours of continuous operation from a complement of batteries.

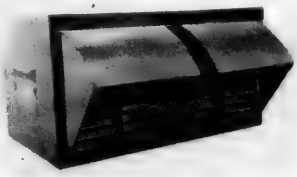
The sensing units, which consist of thermistor pairs in parallel, are hand-calibrated and a standardized replacement service is available and negligible instrument drift is realized.

Each instrument is provided with two input receptacles and a selector switch so that reference-temperature or wet- and dry-bulb readings can be made. The instrument can be used with various sensing-element arrangements including aspirated shields, probes, aircraft wing-mounted shields, perforated shields, and Thornthwaite shields. Sensing elements can be located 800 feet from the instrument with standardized calibration, or, with special calibration, cables as long as 8,000 feet can be used.

More information? Circle Item 29 on postcard, page 151

Twin Fan Cooling Units

Twin fan units powered by one motor, complete with weatherproof all-steel penthouse, automatic shutters, and adapted for exhausting large volumes of air for cooling, ventilating, or removal of fumes and smoke, are introduced by Valley Fan Mfg. Co., Fort Valley, Ga.



All fans are of heavy-duty construction, are belt driven, and equipped with Torrington blades. Fans and penthouses are shipped completely assembled, ready for installation, and are built for both flat or pitched roofs.

The fans are also available in single fan units.

More information? Circle Item 30 on postcard, page 151

Alloy for Pressure Vessels

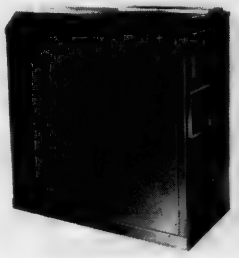
An alloy of aluminum said to offer better mechanical properties than any of the alloys previously approved for welded pressure vessels is being marketed by Aluminum Co. of America, Pittsburgh, Pa. Approved by the ASME under the name Alloy GR40A, the material is commercially designated A54S.

At higher temperatures the alloy maintains its strength better, and therefore is desirable for elevated temperature operation. It can be welded by all conventional methods, but the semi-automatic, inert-gas, metal-arc process and the inert-gas, metal-arc process (tungsten-arc) are preferred. Laboratory tests and vessels in actual use have shown that the tensile strength of butt (groove) welds in this material, using filler of the same alloy, will exceed the minimum tensile strength of the alloys previously approved for welded pressure vessels. Although it is more expensive than these other alloys, it is more economical on the basis of equivalent strength. The weight saved in vessels fabricated from this alloy normally more than offsets the increased cost per pound, and the lighter weight in itself is often an advantage.

More information? Circle Item 31 on postcard, page 151

Third Way of Air Conditioning

A third way of air conditioning, moderately priced, that stands between conventional room units and central systems for conditioning the entire house, is introduced by Remington Corp., Auburn, N. Y. This intermediate type can be placed in the basement, the attic, or the utility room, and by means of ductwork or a plenum space, air condition the two, three, or four rooms that are used the most. Remington's new models, 120 (illustrated), 180, and 250, of 1, 1½, and 2 hp, respectively, with the minimum of ductwork, will air condition the most used living spaces of the average family home, the used bedrooms, living room, and the den. Cooling is not wasted in rooms that are not occupied.



Each Remington unit is a complete air conditioner in itself. Since water supply and drains are not required, a wider selection of locations for the air conditioning equipment is possible. Expensive cutting and patching of walls and structural members is avoided, because air conditioning capacity may be split to provide one unit for upstairs, another for the living-dining floor. The unit in the attic would have ceiling outlets in upstairs bedrooms; the unit in the basement can cool downstairs through diffuser type floor outlets.

More information? Circle Item 32 on postcard, page 151

Cast Iron Solenoid Valves

A line of cast iron and cast steel solenoid valves in sizes from ½ to 2 inches, and for high pressures and temperatures, and designed for handling all media normally injurious to bronze or brass and not harmful to ferrous metals, is offered by Atkomatic Valve Co., Indianapolis, Ind.

Engineering features include stick-free internal design, stainless steel hooded pilot seat screw for more positive closing action and Teflon disks inert to all media except hot flourine.

More information? Circle Item 33 on postcard, page 151

Calibrated Wheels

Calibrated wheels, tradenamed Distometer, and providing a high speed, accurate method of linear measurement for all kinds of terrain or floors, is a development of Rolotape, Inc., Santa Monica, Calif. The wheels come in 3 sizes of 2, 4, and 6 ft in circumference, are easily operated by one man, and replace rules, tapes, yardsticks, chains, and other measuring devices.

Total distance is recorded in feet and inches on a counter and scale on the wheels, circumference. The larger wheels can record distances approximating 19 miles, as they roll over rough or even terrain. They can be operated by the driver of a car as he drives slowly over the course to be measured. The units fold to a compact size for carrying or storage.

More information? Circle Item 34 on postcard, page 151

Non-Corrosive Solenoid Valve

A development in its 3-way solenoid valve group is announced by Automatic Switch Co., Orange, N. J. These Asco solenoid valves are constructed with either steel or stainless steel bodies. Both types have stainless steel trim throughout and are designed to handle gases and liquids corrosive to bronze, brass and cast iron. When equipped with high temperature coils, they handle gases to 450 deg. Valves are available with water tight and explosion-proof solenoid enclosures, otherwise standard enclosures. These valves are packless, having no sliding glands or stuffing boxes.

Direct solenoid operation with force multiplying lever assures reliable operation. The pipe size is 1 inch; port orifices, 5 in number, are ⅛ to ⅜ in., and maximum pressure is 1,000 psi.

These valves are frequently employed for direct control in chemical processing applications to divert and select flow from one or two pipe lines.

More information? Circle Item 35 on postcard, page 151

Baseboard Radiation

The line of baseboard radiation redesigned by Bush Mfg. Co., West Hartford, Conn., has a special punching along the metal back of the baseboard which holds the radiator supports without use of screws or tools. Finger pressure bends forward the pre-punched portions of the back before the baseboard is installed. The radiator supports are then slipped into place after the baseboard has been installed.

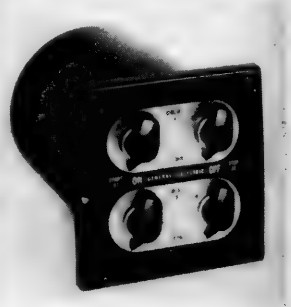
Where greater heat carrying capacity is desired, the company's A type baseboard is now available with a 1-inch, as well as a ¾-inch tube. End closures are fabricated with removable tops to permit access to vents and valves.

Packaging of the baseboard has been improved to simplify the jobbers' storage and pricing problems. Dampers are shipped in cartons containing four 8-foot lengths. These dampers can be transported directly to the job in their cartons and installed without any special measuring or precutting.

More information? Circle Item 36 on postcard, page 151

Process Timer Is Time Saver

A line of process timers for providing accurate, adjustable time-delay opening and closing of electric contacts is offered by General Electric Co., Schenectady, N. Y. Designated Type TSA-18, the timers control such process equipment as dryers, signals and conveyors.



Use of the new timers saves workmen's time, reduces waste material, and improves manufactured products in processes where time is a factor.

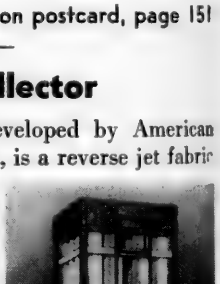
Features include extra heavy nylon gears, over-all construction of almost 100% pure zinc alloys, and a dust-resistant cover. Semi-flush mounting on the face of the timers reduces size and streamlines the equipment. An internally engraved connection diagram, together with screw type terminals, permits easy wiring.

The timer measures 5¾ x 5¾ x 8-5/32 in and weighs 6¾ lb. It operates on a power supply of 60, 50 or 25 cycles, with a contact rating of 10 amps at 120 volts or 5 amps at 240 volts.

More information? Circle Item 37 on postcard, page 151

Reverse Jet Dust Collector

The Amerjet dust collector, developed by American Air Filter Co., Inc., Louisville, Ky., is a reverse jet fabric collector designed for those applications where extremely fine particles are involved or where the material must be collected in a dry state for reclaiming.



The cleaning medium is automatically reconditioned by a jet of high pressure air forced through the cloth in opposite direction to the flow of the air being cleaned. Because the cleaning cycle is continuous, the dust collector maintains a constant pressure drop and thus a steady air volume at the exhaust points.

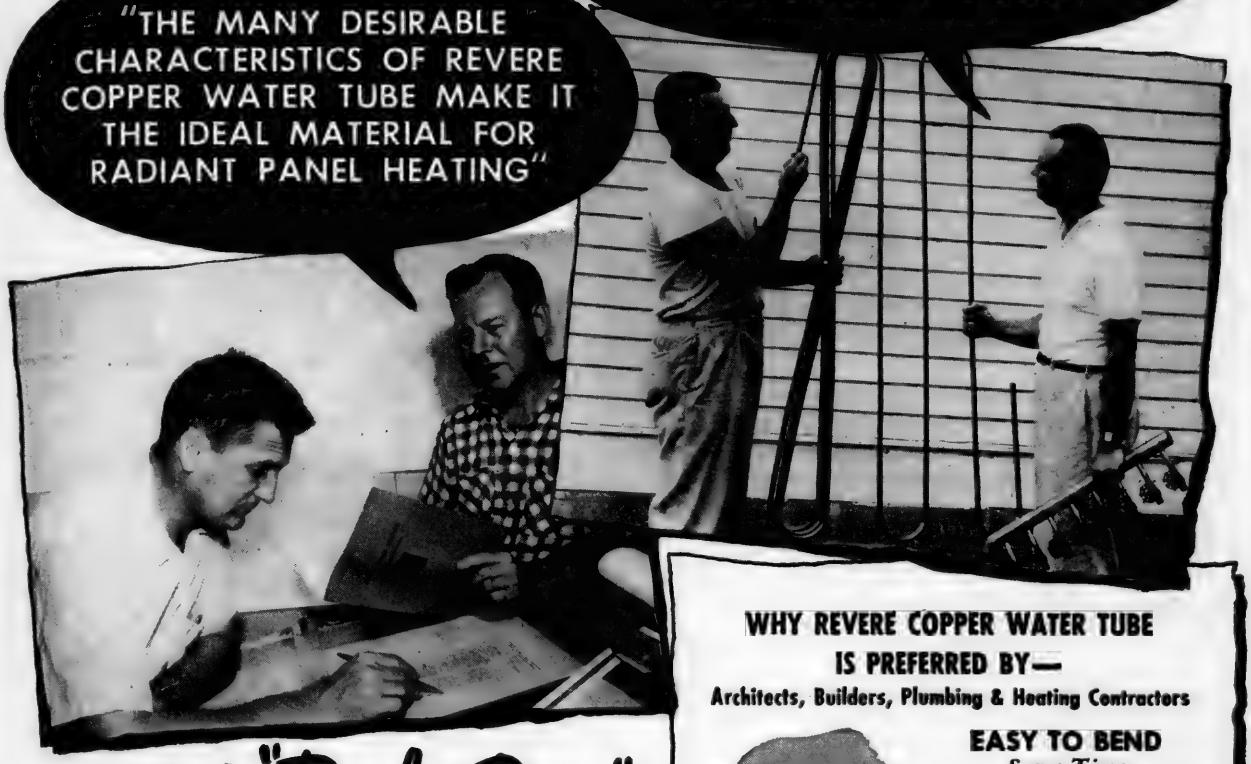
This method of reconditioning the filtering medium permits higher velocities through the cleaning tubes. Therefore, less filter cloth is needed for any given cfm.

More information? Circle Item 38 on postcard, page 151

(*Continued on page* 136)

"PREFABRICATION IS EASIER, TOO, SAVES TIME AND LABOR ON THE JOB"

"THE MANY DESIRABLE CHARACTERISTICS OF REVERE COPPER WATER TUBE MAKE IT THE IDEAL MATERIAL FOR RADIANT PANEL HEATING"



...say the "Bagley Boys"

OF ROBERTSON, MO.

Directly above you see Mr. Eble, Chief Design Engineer (left) and Mr. R. Bagley conferring on a radiant panel heating job. Says Mr. Bagley, "Because of the superiority of radiant panel heating we recommend it every chance we get. We must give copper the credit for putting radiant panel heating on a competitive basis with inferior methods of heating, because of its many outstanding features. As it has been pointed out many times: 'There is not another metal or alloy that has *all* the desirable construction characteristics of copper.' Why shouldn't we prefer it?"

At top right, Mr. R. W. Hardy holds a preformed radiant panel heating coil assisted by Mr. Harry Smith who has a prefabricated distribution manifold in his hand. Says Mr. Smith, "One answer to keeping radiant panel heating costs down is prefabrication. That's why we prefer Revere Copper Water Tube: It is ideally suited to preforming and the techniques used to install radiant panel heating."

It's good advice the "Bagley Boys" offer. Use Revere Copper Water Tube for radiant panel heating, hot and cold water lines, underground service lines, air conditioning and processing lines, waste stack and vent lines. There is a Revere Distributor near you who carries a full supply of Revere Copper Water Tube in various sizes and tempers. And if you have technical problems, he will put you in touch with Revere's Technical Advisory Service.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

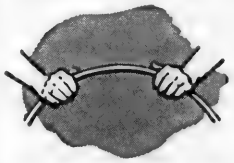
• • •

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.— Sales Offices in Principal Cities, Distributors Everywhere.

SEE "MEET THE PRESS" ON NBC TELEVISION, SUNDAYS

WHY REVERE COPPER WATER TUBE IS PREFERRED BY—

Architects, Builders, Plumbing & Heating Contractors



EASY TO BEND

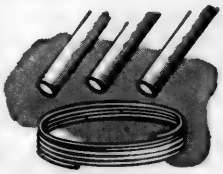
Saves Time

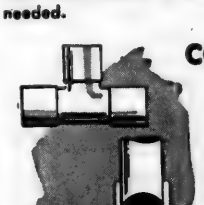
Revere Copper Water Tube is easy to bend. Soft temper can be bent by hand to meet installation conditions.

HANDY LENGTHS

Save Fittings... Labor

Revere Copper Water Tube comes in straight lengths of 20' in hard and soft tempers. 60' coils of soft temper reduce the number of fittings needed.





SOLDER OR COMPRESSION FITTINGS

Need Less Work Room ... Save Metal

No worry about wrench room when you use Revere Copper Water Tube with solder fittings. Compression fittings can also be used. No threading is necessary with either type fitting. Wall thickness of tube used can thus be less than for threaded pipe.

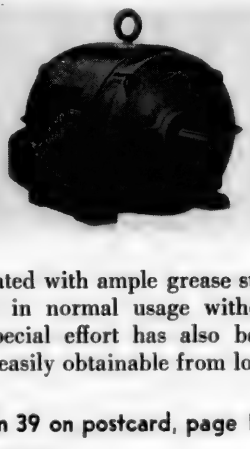
NON-RUSTING

Rustable pipe eventually clogs as shown in drawing at top right. Non-rustable Revere Copper Water Tube suffers no loss of flow or pressure as shown at bottom right. No allowance in pipe size need be made for rust accumulation with Revere Copper Water Tube.

(*Continued from page* 134)

Redesigned Electric Motors

A redesigned line of electric motors to meet new NEMA rating standards has recently been announced by The Louis Allis Co., Milwaukee, Wis. These motors are available in all standard enclosures—open, drip-proof (illustrated); totally-enclosed, fan-cooled; and explosion-proof. They are built up to frame size 326 (40 hp at 3600 rpm). They provide more power in a smaller package, modern styling, improved ventilation, and greater protection.



Bearings are factory-lubricated with ample grease supply to give years of service in normal usage without maintenance or attention. Special effort has also been made to use bearings that are easily obtainable from local stocks.

More information? Circle Item 39 on postcard, page 151

Packaged Automatic Boilers

The extension of its Model 4 line of Powermaster packaged automatic boilers through 100 hp. size, is announced by Orr & Sembower, Inc., Reading, Pa. These boilers have previously been available in smaller sizes with a standard pressure-atomizing oil nozzle for firing light oil only. The line is being constructed for other fuels as well, the model designations being 4L for light oil firing, 4G for gas firing, and 4LG for gas or oil firing.

This line is that of a three-pass boiler with a single flue, gas flow reversal at either end. A minimum of 5 sq. ft. of heating surface is provided per boiler hp. Three-pass design provides convenience for inspection and cleaning.

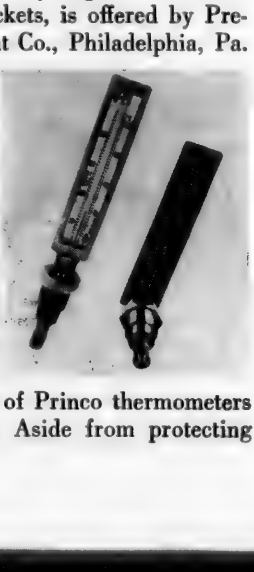
Forced draft eliminates the need for an unsightly stack. All programming and safety controls are automatic.

More information? Circle Item 40 on postcard, page 151

Industrial Thermometers

A line of 5 inch scale, mercury-in-glass industrial thermometers, with separable sockets, is offered by Precision Thermometer & Instrument Co., Philadelphia, Pa.

Designed specifically for restricted-space applications, these thermometers are offered in a choice of five different case angles: straight, 90 deg rear angle, 90 deg right and left side angles, and 135 deg oblique angle. There is also a choice of five different scales: —40 to 110 deg F, 30 to 180 deg F, 30 to 240 deg F, 30 to 350 deg F and 200 to 500 deg F.



Most important single feature of Princo thermometers is the separable socket or well. Aside from protecting the thermometer bulb against process conditions, a separable socket permits the thermometer proper to be removed without leaving an opening in the line or other apparatus. These sockets are threaded for both ½ and ¾ inch NPT. Illustration shows detail of the dual-diameter threaded shoulder. Sockets are furnished in brass, steel and stainless steel, in two different stem lengths.

More information? Circle Item 41 on postcard, page 151

Non-Plasticized Valves

A complete line of non-plasticized Type I PVC needle, plug and globe valves in sizes ranging from ⅛ to 2 inches is avaliable from Atlas Mineral Products Co., Merztown, Pa. These units supplement Ampcoflex Type I and Pee Vee Cee Type III sheet, pipe and fabricated structures.

More information? Circle Item 42 on postcard, page 151

Commercial Kitchen Exhauster

A kitchen hood exhauster, Model KE-9, designed for continuous duty with 8, 9 and 10-inch ducts is being marketed by The Peerless Electric Co., Warren, Ohio. The unit is built in 1/6, ¼ and ½ hp sizes with 1750 rpm motors, and is intended for small commercial kitchens.

The cast-aluminum, self-cleaning wheel is dynamically balanced and can be turned for the type of discharge desired. It will not load up with grease or dirt to retard air flow.

Unit is compact and easily installed; has resilient mounting, automatic thermal overload protection; and, sleeve bearings. Drive covers are available for outside installations.

The kitchen hood exhauster is designed to meet the need on small jobs which comprise 50% of all commercial kitchen exhaust jobs.

More information? Circle Item 43 on postcard, page 151

End Mounted Chemical Pumps

A line of end-mounted chemical pumps for acids, caustic solutions, solvents, and liquefied gases, is announced by Roy E. Roth Co., Rock Island, Ill. The line consists of 27 models suitable for heads up to 600 feet in a single stage and capacities from 1 to 100 gpm.

All models are equipped with high pressure flanged connections and are available in 316 stainless steel, 304 stainless steel, cast carbon steel, Hastelloy C, Durimet 20, and nickel, as well as bronze and cast iron.

Seven different types of mechanical seals are furnished, each in several combinations of metals and gasketing.

Section 100, a 24-page booklet describing the line is available.

More information? Circle Item 44 on postcard, page 151

Chamber Type Vent Valve

A chamber vent that creates a high point for the collection of air is a development of Keeney Mfg. Co., Newington, Conn. Designed for hot water systems, the Duovent is recommended for baseboard and convector radiation because it is readily accessible from any angle.

Critical adjustments to the vent are unnecessary; its automatic venting action is set at the factory. The vent is so designed as to eliminate the need for several joint connections and nipples.

Made in plain brass and chrome finish, the standard model No. 36 (illustrated) measures 3⅜ inches from the bottom of the box to the top of the valve.

A shorter model, No. 35, is also available.

More information? Circle Item 45 on postcard, page 151

New Wiring Insulation Used

A new moisture-proof, high-voltage insulation is being used for internal wiring of the electronic instruments manufactured by the Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

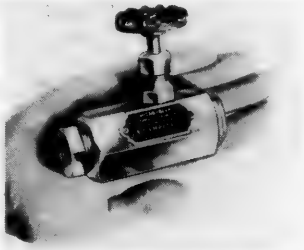
The insulation, a thermoplastic material, is impervious to moisture and thus is recommended for use where high humidity conditions prevail.

For identification, the insulation comes in 10 base colors. Where tracers are required the insulation is white with two identically colored helical stripes to identify the base color and a third stripe to show the tracer color. Input circuit wiring will be solid white covered by color-coded rayon braid.

More information? Circle Item 46 on postcard, page 151

Pulsation Dampener

An improved pulsation dampener to be installed on gage and governor lines is developed by J. A. Campbell Co., Long Beach, Calif. Known as the Micro-Bean, the device has been redesigned to a shorter length and equipped with a filter of stainless steel to prevent corrosion.

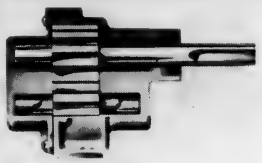


The body is all brass for 3000 lb operating pressure, steel with stainless steel micro-valve for 6000 lb pressure, or all stainless steel for 10,000 lb pressure. The valve on the device has a 96 to 1 taper to eliminate stem and screw compression strain. When installed ahead of a gage or governor, jitters of the gage pointer are minimized, pulsation is dampened and the line flow is smoothed. The device is now made with both female threads, ¼ or ½ inch.

More information? Circle Item 47 on postcard, page 151

Gear-Type Pump for Oil

A gear-type pump with speeds up to 1725 rpm, designed for light liquids, or, at slower speeds, for heavy liquids such as molasses, heavy oils, and chocolate syrup, is introduced by Eclipse Fuel Engineering Co., Rockford, Ill.



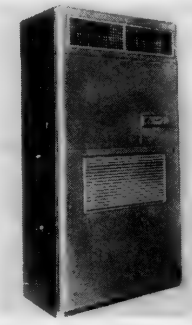
Gear-type construction of the EO pump permits pressures up to 100 psi. It can be operated in either direction of rotation. The pump has mechanical seals which require no adjustment. Carbon bearings, tough bronze alloy gears and case, and micro finish stainless steel shaft are other features.

The pump is available as a complete unit with base, coupling and motor; as a complete assembly less motor; or as a replacement alone.

More information? Circle Item 48 on postcard, page 151

Adds 3 Unit Air Conditioners

Three new self-contained, electric air conditioners are offered by Servel Inc., Evansville, Ind., in a range of three cooling capacities, 3 tons (illustrated), 5 tons, and 7½ tons. They are powered by the company's electric compressors.



These air conditioners are designed for use in stores, factories, and offices. They can also be adapted for use with existing residential warm-air furnaces. Requiring small space, these conditioners are easy to install and service. They range in height from 75 to 92 inches; in width from 38 to 48 inches; and in depth from 20 to 26 inches.

Cooling capacities are 36,000, 60,000, and 90,000 Btu per hour.

More information? Circle Item 49 on postcard, page 151

Line Operated pH Meter

A line-operated pH meter, Model No. 115, introduced by Photovolt Corp., New York, N. Y., bridges the gap between electronic pH meters of earlier design and visual color comparison tests of limited accuracy, and offers the advantages of the glass electrode pH meter in accuracy and reproducibility.

Speedy, direct readings are obtained without the use of dials or buttons.

There is no amplifier drift after short warm-up. The meter is simple to maintain, having only two miniature tubes, and is unaffected by the usual voltage fluctuations within 95—130 volt range.

Compact in design, the meter measures 5½ x 7½ x 3 inches, and weighs 3 lb. It operates on 50-60 cycle AC.

More information? Circle Item 50 on postcard, page 151

How Honeywell Customized Temperature Control helps provide

The kind of "Indoor Weather" your clients need

Customized Temperature Control installation at Corning Glass Center is a good example.

AT THE Corning Glass Center in Corning, New York, you'll find a museum, offices, shops—and production areas where Steuben glassware is made.

Such a variety of functions under one roof calls for scientific temperature control—if the "indoor weather" is to be comfortable throughout the building.

Today the best way to provide proper "indoor weather"—whether a building houses one function or many—is through the use of *Honeywell Customized Temperature Control.*

The key word here is "customized". It means that whatever your clients' control requirements, a Honeywell Customized Temperature Control installation *designed to fit the needs of the building and its occupants is your answer.* This applies not only to heating and cooling, ventilating and humidity control—but to industrial control as well.

Only Honeywell can provide true "customized" control. Because only Honeywell manufacturers all three types of controls—pneumatic, electric and electronic.

The story, in brief form, of the Honeywell Customized Temperature Control installation in the Corning Glass Center is told by the floor plan and picture captions you see here.

They tell how specific occupancy, use and exposure problems were met.

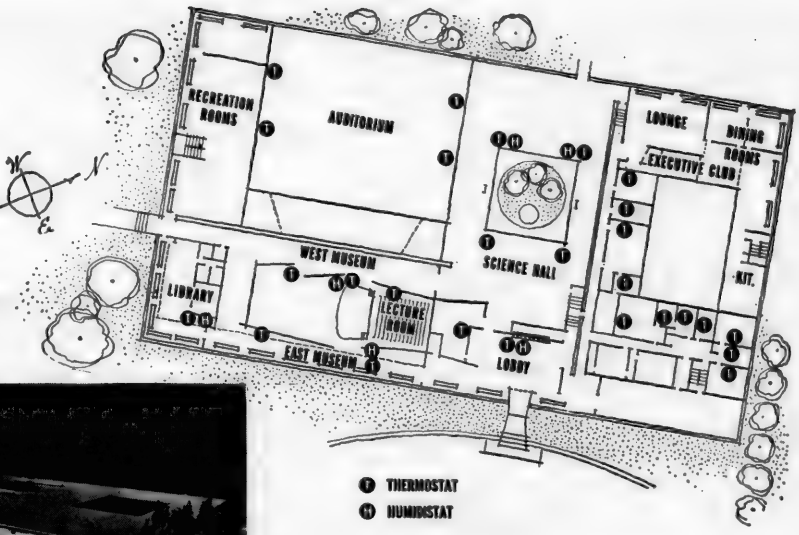
The *techniques* used, applied to your particular problems, can help you give your clients the "indoor weather" they've always wanted.

Interior garden of Corning Glass Center

Architects: Harrison, Abramovitz and Abbe, New York, N. Y.

Mechanical and Electrical Consulting Engineers: Jaros, Baum and Bolles, New York, N. Y.

Air Conditioning Consulting Engineers: Henry Peck Associates, Fairport, N. Y.



This panorama of the Corning Glass Center shows the temperature control problems involved. Huge glass window areas face four directions. Whether it is sunny or cloudy makes a big difference to the heating and cooling system. But Honeywell Customized Temperature Control, using electronic and pneumatic thermostat and humidistats, keeps the building comfortable all the time.

Interior heating and cooling factors are important, too. Take the auditorium above, for instance. With a large crowd you have one heating problem. With a small group, quite another. But the four Honeywell thermostats located here handle either situation easily.

The internal heating problem in the display room above is somewhat similar to that of the auditorium. But when it is crowded (requiring little heat) the auditorium might need considerable heat. Yet with enough thermostats, strategically placed, both areas are comfortable.

For comfortable, even temperature in new or existing buildings—of any size—specify Honeywell Customized Temperature Control

Whether it's a factory, motel, hospital — any building of any size — new or existing, Honeywell Customized Temperature Control can help meet your clients' heating, ventilating, air conditioning and industrial control problems. You can give your clients more comfort and efficiency. And they'll save fuel, too.

For full facts on Honeywell Customized Temperature Control, call your local Honeywell office. Or mail the coupon today.

James M. Brown, III, director of the Corning Glass Center, says:

"Today our Glass Center is one of the most comfortable buildings in the country. Important in helping make possible this comfort is our Honeywell Customized Temperature Control installation."

MINNEAPOLIS
Honeywell

First in Controls

104 OFFICES ACROSS THE NATION

Minneapolis-Honeywell Regulator Co.
Dept. HV-3-60, Minneapolis 8, Minnesota

Gentlemen:

I'm interested in learning more about Honeywell Customized Temperature Control.

Name.....

Firm Name.....

Address.....

City..... *Zone*..... *State*.....

PRODUCT APPLICATIONS

New, Unusual, or Ingenious Uses of Equipment and Materials

Conducted by WM. B. FOXHALL, Associate Editor

191-Ton Packaged Cooling Program

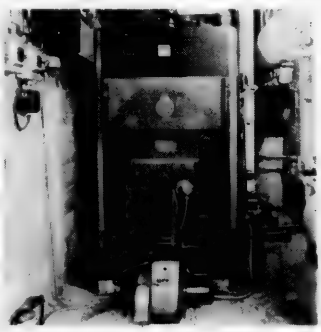
PROBLEM: Owners of an Elizabeth, N. J., department store decided to install air conditioning and inquired into the possibility of a central station system. It was pointed out that such a system would require extensive store remodeling and an extremely high initial investment.

SOLUTION: An engineering survey revealed that packaged air conditioners could be located in little-used spaces and would require a minimum of air ducts. An initial installation was made in 1949 on a trial basis and consisted of four 5-hp and one 3-hp Chrysler Airtemp units located in the women's wear department on the second and third floors. After a season of successful operation, the decision was made to complete the cooling installation for the entire store. Over a 4-year period, the Elizabeth Chrysler Airtemp dealer installed twenty-one 8-hp, four 5-hp, and one 3-hp packaged air conditioners in the five-floor building. All sales and administrative departments are now fully air conditioned.

RESULTS: Women's wear sales persons found it was easier to have customers try on garments even on the hottest days. Increased sales and more satisfied customers and employees were reported by the store management. By installing a packaged system, the company was able to spread its investment outlay over a 4-year period.

Double Boilers Zone Motel Heat

PROBLEM: At two motels operated by Tom Sawyer Motor Inns in New York State, rental units are arranged in two rows of rooms facing in opposite directions. One line of rooms faces the highway, and a parallel run of rooms along the rear of the building faces the open valley beyond. By opening a connecting door, a suite of at least two bedrooms and two baths is made available for family use. An arrangement was required for zone distribution of hot water through radiant panel heating systems serving the double rows of rooms.



SOLUTION: Two hot water boilers, made by National Radiator Co., Johnstown, Pa., serve each of the motels. Boilers are also used to provide domestic hot water for as many as 200 overnight guests. Inside and outside thermostats control oil burners used in the boilers.

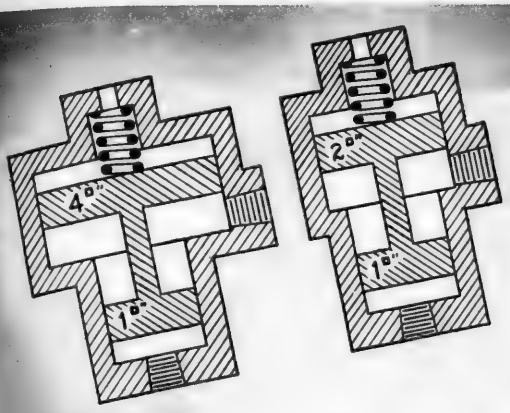
RESULTS: Boilers have been in operation from 4 to 6 years without any expenditure for maintenance. Costs for heating and hot water were well within initial estimates.

Electric Cables Melt Snow

PROBLEM: In many special cases it is inconvenient to install embedded pipes for snow melting, especially where structures are not heavy enough to carry the additional load or where hot water or steam is not available.

SOLUTION: Several new applications of Chromalox electric heating cable are reported by the manufacturer, Edwin L. Wiegand Co. of Pittsburgh, Pa. One example is the installation of cable in the canopy over the entrance to the new Alcoa Building in Pittsburgh. The company installed 1600 feet of the cable on top of the canopy's cantilevered concrete shell shown in the two upper photographs. Installed capacity is 8 kilowatts. The manufacturer of the heating cable uses its own product in two other snow melting installations shown in the lower photographs. The cable is embedded in two tracks on the slope of a driveway to the parking lot and in a concrete sidewalk around a warehouse. The cable has also been installed around several stacks on the roof of the plant to prevent condensation from forming inside. Trade name of the heating cable is Thermwire.

RESULTS: Snow load on a building canopy is eliminated as is the hazard of falling snow from the curved surface of the canopy. Access to a parking lot up a sloped driveway is made safe under icy weather conditions. Movement of materials and personnel around a warehouse is made safer and easier. Corrosive condensate is prevented from forming in stacks.



Do You Know Why 'HIGH RATIO' TRAPS *by* NICHOLSON DRAIN CONDENSATE FASTER?

IF you were asked, "Which of the two differential pistons sketched above will require the least pressure drop before the piston assembly can move up?" you would obviously answer, "The one at the left". Because of the higher ratio between the areas of its upper and lower pistons.

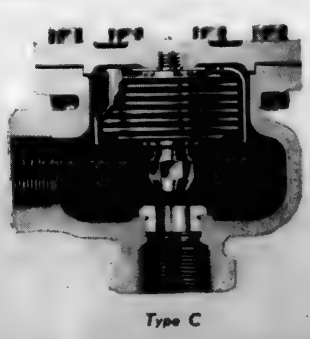
Now the line pressure in a thermostatic bellows trap is analogous to that in a differential piston. The higher the ratio of bellows area to discharge orifice area the less the pressure drop required before the bellows will contract and open the discharge valve.

Getting down to cases, the Nicholson thermostatic trap has a larger bellows than any other trap of this type, while its discharge valve orifice is approximately equal in size to any other trap. This gives a higher ratio and causes the Nicholson trap to operate on the least temperature difference between steam and condensate.

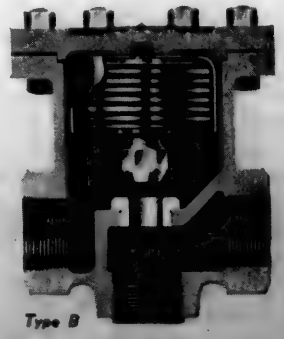
Now take the case of two traps with discharge valves of equal size and assume that they are operating at a given temperature difference.

The Nicholson "High Ratio" trap will open its valve wider and have larger capacity than the low ratio trap.

This is a reason why a Nicholson thermostatic trap operates faster and keeps a unit full of live steam. And, may we add, it's one of the advanced features that are influencing plant engineers increasingly to standardize on Nicholson.

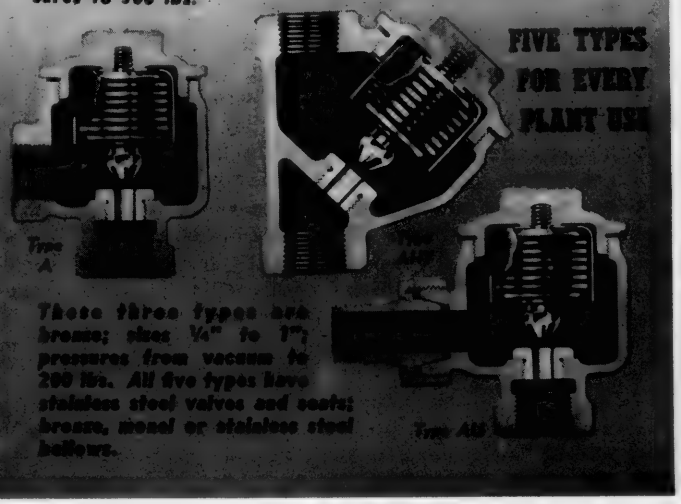


Type C



Type B

The two types above are semisteel; sizes ½" to 2"; pressures from vacuum to 250 lbs. Type C also in cast steel for pressures to 300 lbs.



These three types are bronze; sizes ¼" to 1"; pressures from vacuum to 200 lbs. All five types have stainless steel valves and seats; bronze, monel or stainless steel bellows.

Send for NICHOLSON TRAP CATALOG 953

Catalog 953 contains capacity tables, installation diagrams, and data, charts and formulae for determining the proper size trap.

W. H. NICHOLSON & CO.

199 OREGON ST., WILKES-BARRE, PA.

Sales and Engineering Offices in 53 Principal Cities

Concrete Drilled with Diamonds

PROBLEM: The George H. Soffel Co., plumbing and heating contractors working on the St. Clair housing project in Pittsburgh, had difficulty setting sleeves for riser pipes during pouring of concrete floor construction. Sleeves tended to tip or shift in position.

SOLUTION: Rather than set sleeves, operators decided to drill holes for 1½- and 2-inch pipe. After trying various kinds of drills, it was found that the hard concrete could be drilled at low cost by the Penn-drill Model E diamond core drill, product of Pennsylvania Drilling Co., Pittsburgh. Thousands of holes were drilled at the rate of about one per minute. The drilling unit includes a lever operated press for advancing or retracting the bit at any angle.

RESULTS: Holes are drilled through hard concrete, poured over the steel mesh taper at less cost than setting sleeves for risers or conduit pipes. Cost of diamond bits was less than 20 cents per hole.

Air Filter Stops Germs

PROBLEM: Princeton Laboratories, Inc., Princeton, N. J., required an air conditioned sterile room for preparation of hormones and enzymes.

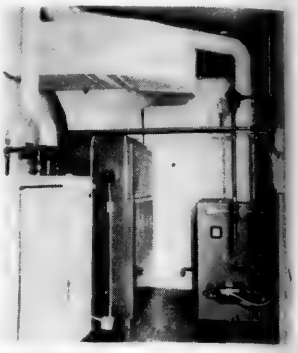
SOLUTION: A dry filter system using a new type filter element was installed. The system uses a filter unit capable of stopping particles as small as freshly generated tobacco smoke. This is the Ultra-Aire filter, product of Mine Safety Appliances Co., Pittsburgh, Pa. The equipment consists of a sheet metal duct into which four removable filters are clamped and sealed. A standard blower is driven by a ¼-hp motor. The blower and duct work are mounted on the top of the sterile room and connected to an opening in the ceiling. The first three of the four filters are standard 10 by 20 inch glass filters which remove the largest particles from the air. The fourth filter is an Ultra-Aire filter, 24 by 24 inches, and 5⅞ inches thick, which removes the finest particles. This filter unit has an initial pressure drop of 0.2 inch of water at 100 cfm and stops all particles in excess of 0.3 micron in diameter. It consists of about 150 square feet of filter paper, fan-folded over special corrugated paper spacers.

RESULTS: The filter system delivers 50 to 100 cfm of fresh sterile air. This adds greatly to the comfort of those in the room and permits working there continuously instead of for short periods during which no fresh air could be safely added to the 850 cubic feet of air sterilized only by ultra-violet light.

Twelve-Room Home Centrally Cooled

PROBLEM: In a twelve-room house in New Orleans, air conditioning was to be installed in a system using a hot water boiler for winter heat.

SOLUTION: A 7½ ton self-contained Frigidaire air conditioning unit is located in the utility room on the first floor. The air conditioner is installed in conjunction with a hot water boiler and a two-row heat coil for heating purposes during the cooler season. When cooling is desired, the boiler is cut off and cooling cut in. When heating is called for, the hot water is circulated through heat coils in the same duct system used for cooling. Blower fans in the Frigidaire unit provide air distribution to all parts of the house for both cooling and heating operations. A 7½ ton water cooling tower was also installed to provide savings in water usage during the cooling operation. Thermostats are located in both upstairs and downstairs halls, and a switch near the downstairs thermostat allows the occupant to select which of the thermostats is to do the controlling of either heating or cooling.



RESULTS: The home has an atmosphere that is comfortable, healthful and pleasant to live in. Since windows and doors are closed most of the time, dust and dirt cannot get in to soil furnishings and drapes. Outside air is filtered and dehumidified. Air circulation is controlled to avoid drafts and correct temperatures are maintained at all times.

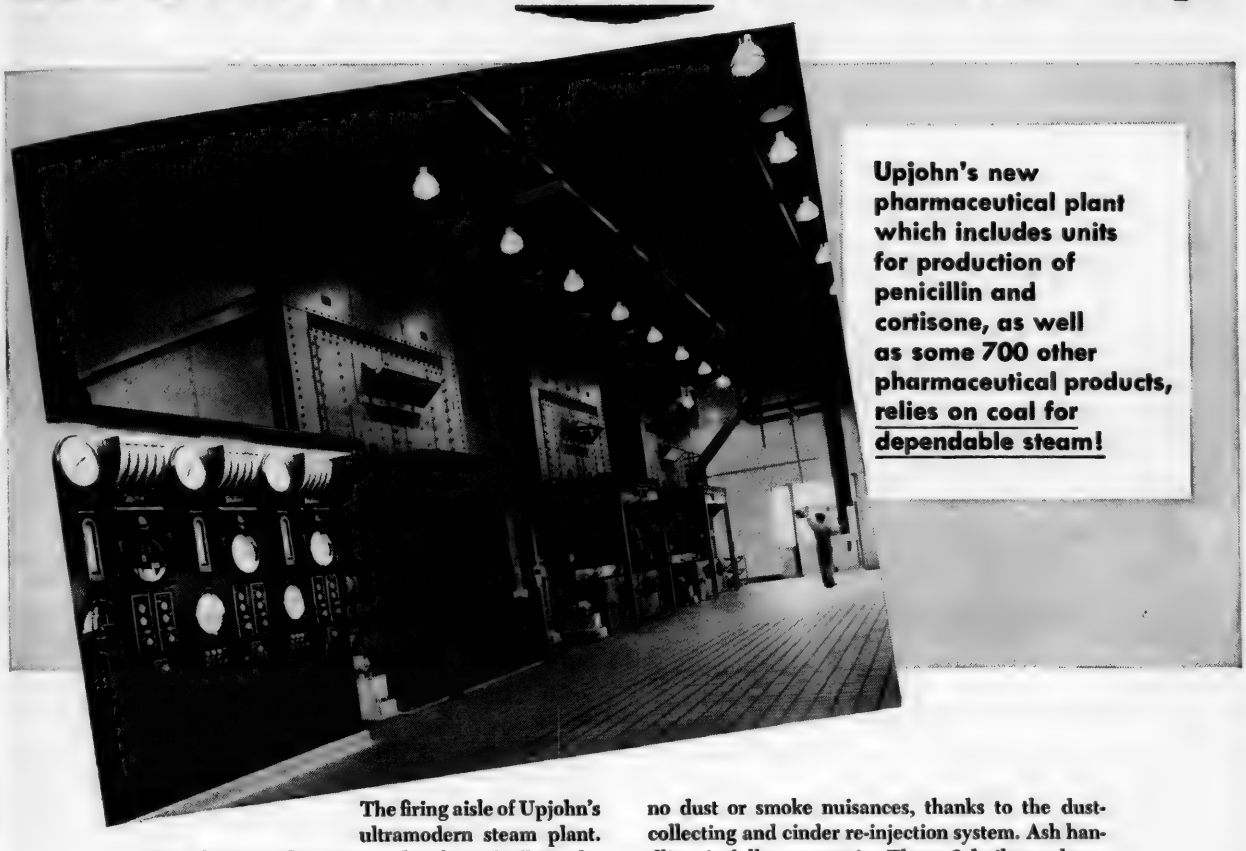
Fans Condition Knitting Mill

PROBLEM: At three separate locations in the Excelsior Knitting Mills in Cleveland, where drying and steam table operation are performed, heat and moisture can interfere seriously with production of fine quality cashmere sweaters and other knit goods.

SOLUTION: A battery of 15 axial flow exhaust fans, PVS-18, product of Peerless Electric Co., Warren, Ohio, was installed in three sections. One section serves the drying room and the other two are located in two steam table locations. Each fan is installed in an outside window and exhausts hot, humid air at the rate of 2,900 cmf. Three-speed motors are totally enclosed to exclude dirt and moisture.

RESULTS: Knit goods can be steamed to relax the yarn and help shape the garment without creating intolerable working conditions in the steam room. Moisture given off during drying operations is exhausted without creating unfavorable conditions in the plant.

For LOW-COST DEPENDABLE steam, UPJOHN burns COAL the modern way!



Upjohn's new pharmaceutical plant which includes units for production of penicillin and cortisone, as well as some 700 other pharmaceutical products, relies on coal for dependable steam!

The firing aisle of Upjohn's ultramodern steam plant. This plant supplies steam, cleanly and efficiently, at only 40¢ to 42¢ per 1,000 lbs. for the Portage Road Plant near Kalamazoo, Michigan. There are no dust or smoke nuisances, thanks to the dust-collecting and cinder re-injection system. Ash handling is fully automatic. These 3 boilers, plus a fourth recently installed (not illustrated), deliver up to 115,000 lbs. steam per hour at peak load.

Whether you're building a new plant or modernizing an older one, you can count on coal for dependability and low-cost operation.

Here's why: Up-to-date coal-burning equipment can give you 10% to 40% more steam per dollar. Automatic coal- and ash-handling systems can cut your labor cost to a minimum. Let a consulting engineer show you how a modern coal installation, tailored for your specific needs, can save you real money.

Here's something else, too—of all fuels, coal alone has virtually inexhaustible resources. This, plus the fact that America's highly mechanized coal industry is the most efficient in the world, assures you of a dependable supply of coal at relatively stable prices now and for years to come.

If you operate a steam plant, you can't afford to ignore these facts!

COAL in most places is today's lowest-cost fuel.

COAL resources in America are adequate for all needs—*for hundreds of years to come.*

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

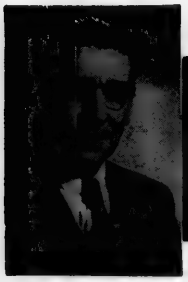
COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

BITUMINOUS COAL INSTITUTE

A Department of National Coal Association, Washington, D. C.

FOR HIGH EFFICIENCY *FOR LOW COST*

YOU CAN COUNT ON COAL!



Experience is my Classroom

By T. W. REYNOLDS

• HIGH TEMPERATURE HOT WATER

There is occasional discussion on the high temperature or superheated water system. Advantages and disadvantages of the system follow:

It lends itself to ease of regulation to conform with load variations. Heat losses, common with steam pumps and steam traps, are avoided since such units are not required. Existing plants can be extended by installing heat storage accumulators to provide the additional capacity required, heat being thereby stored in off peak periods.

It may be used for housing projects near district steam systems using heat exchangers to provide hot water for radiant heating. Compared to a heating boiler in each house, it is highly efficient, especially so considering that some of the separate boilers and water heaters may have less efficiency with time or lack of maintenance of scattered boilers.

Disadvantages, but not unsurmountable or unreasonably difficult, are that the use of small pipes requires closer determination as to sizes, valve spindles sometimes encrust due to evaporation at leaks, and there is no evidence of drippage to disclose such leaks. There are water pumping costs to be considered. Variations in pressure must be slowly obtained, and if pressure is not maintained, there may be flash steam and a consequent dangerous water surge. Of course, the use of heat exchangers confines these to the boiler plant of the district steam system.

• BYPASS SIZE AT REDUCING VALVES

Determining the bypass size around a steam pressure reducing valve has always been by rule of thumb, possibly because the function of a bypass, a temporary or emergency manually controlled device, is not generally understood. Designers may size the bypass pipe and its valve with some relation to the nominal pipe size or inside area of the high pressure main, such as:

(1) Two pipe sizes smaller, and (2) Inside area 40%
(3) One half the pipe size.

Rule 3 is sometimes modified to obtain a fourth rule, that is to halve the pipe size of the low or reduced pressure main. Rule 3 is the one most commonly used.

With a velocity in the high and low pressure mains of 6,000 fpm, the velocity in the bypass on its high pressure side to the bypass valve, will vary according to the high pressure main size from 12,000 fpm to 15,000 fpm for (1), 15,000 fpm for (2), and 24,000 fpm for (3) and (4). Raise the velocity of 6,000 to 10,000 fpm and the bypass velocities would increase to 20,000 fpm and 25,000 for (1); 25,000 fpm for (2); and 40,000 fpm for (3) and (4).

These velocities appear rather high, but they exist only in a short run of pipe and may be considered low compared to the velocity through the orifice of the reducing valve, although not low after being expanded in the low pressure side of the bypass. It is apparent, therefore, that Rule (3) and (4) will give rather excessive velocities through the low pressure side of the bypass when the desired drop is high. It is also apparent that with very low pressure differentials, the entire bypass should be almost as large in size as the mains.

When there is any doubt as to proper size, two bypasses of the same or unequal size can be used, and where the pressure reduction is rather high, two-stage reduction can be used. Where velocities in the main are very low due to conservative design or over-estimation of load (as more likely), the bypass size as obtained by rule of thumb will be too large. With very high main velocities, the bypass size may be too small. These thoughts show that while it may not be necessary to expend too much time in refining the size of bypass, some consideration should be given to the particular job conditions.

Theoretically a bypass should be sized strictly on the maximum flow to be passed when the reducing valve is shut off in order to maintain the full load of the system at the pressure required. This would be just a matter of sizing pipe like in any heating system. Perhaps the most logical procedure would be to proportion the bypass so that it will permit steam flow such that the desired reduced pressure will obtain for the maximum initial pressure to be maintained. On this basis, the bypass size would be determined as the flow through a short tube. Another way of saying this is to so size the bypass that its total resistance to maximum flow would be no greater than the differential through the reducing valve.

Things in favor of small bypass sizes are economics due to smaller pipe, valve, fittings and insulation and the greater pressure drop obtained, increasing with the velocity. In any event, the bypass valve has infrequent and short duration of use, and its lift obtainable is high compared to that in the reducing valve. It is but logical, however, to say that the bypass may never have to be used, since if this were the case it need not be installed, but it is more logical to say that it may never have to be used during the peak of warming up load. The larger a bypass valve (1) the harder it will be to regulate the reduced pressure, (2) the more frequent the manual operation required to prevent pressure build up, and (3) the greater the wire drawing on the valve seat with frequent use. Incidentally, the pressure drop in a bypass is greater than commonly thought, for although usually short, it contains a high resistance globe valve, 90 degree fittings and some small pipe in which there is high velocity. A bypass provides additional capacity if ever required. It may also be used for slow warming up of cold mains before allowing the reducing valve to take over.

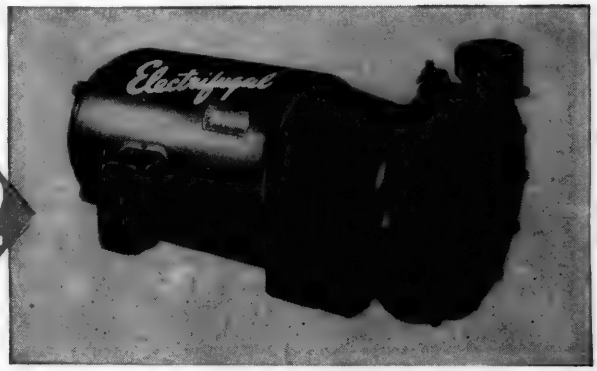
ALLIS-CHALMERS

Air Conditioning PUMPS

3 Ways to Save

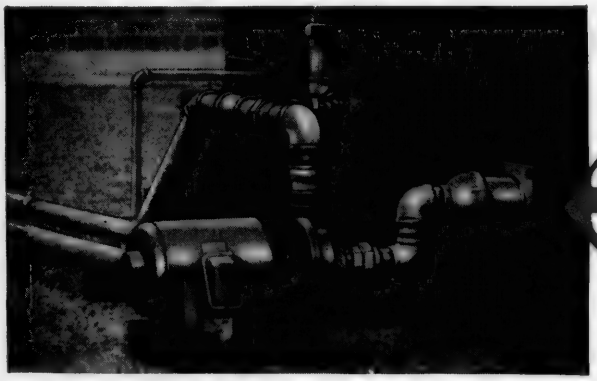
SAVE ENGINEERING TIME

Allis-Chalmers representative will sit down with you in the planning stage and help you design the best possible air conditioning pump set-up at the lowest cost. A-C field engineers will save you much costly engineering work and *guarantee* the complete pump and motor unit.



SAVE—NO EXTRA PARTS TO BUY

Designed as a complete, compact unit, Allis-Chalmers close-coupled pumps don't require extras — such as couplings, bases or shims. The pumps come as units ready to hook up and run!



SAVE ON INSTALLATION TIME

Bolt it down, hook up the line and piping, and your Allis-Chalmers pump is ready to go. There's no alignment problem. Correct installation is a big factor in pump performance and the A-C engineer will advise you at this point.

For more information about Allis-Chalmers air conditioning pumps, write for bulletins 52B6140, 52B7529, 52B6083 or 52B6975.
ALLIS-CHALMERS, Milwaukee 1, Wisconsin

FHP PACKAGE PUMP

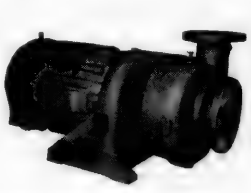
Standard with mechanical seal. Widely used and accepted for air conditioning and refrigeration.

Bulletin 52B7529

***ELECTRIFUGAL* PUMP**

A close-coupled pump with either conventional packing or mechanical seal.

Bulletin 52B6140



SUPPORTING ADAPTER PUMP

Flange motor and pump on sturdy supporting adapter. With conventional packing or mechanical seal.

Bulletin 52B6083

VERTICAL MOUNTED PUMP

Mechanical seal or sealless units with choice of submerged or sidewall mounting.

Bulletin 52B6975

Electrifugal is an Allis-Chalmers trademark.

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Abstracts AND Reviews

Publications abstracted in this department should be ordered direct from publisher.

FLOW AND FAN

The how and why of basic calculations in the design of systems for moving air or other gases are thoroughly covered in Flow and Fan by C. Harold Berry, Gordon McKay, Professor of Mechanical Engineering, Harvard University.

The title, Flow and Fan, is derived from the two major divisions of treatment; (1) the flow of gas through duct systems and (2) fan performance and control. In the seven chapters on gas flow, basic methods are presented for finding system resistance; the final six chapters are devoted to the practical task of selecting a fan for a given duty.

The book has a twofold objective—to meet the needs of students who are interested in acquiring a working knowledge of ventilation, and to serve as a reference volume for the practicing engineer. It is an outgrowth of lecture notes developed for a course given by Prof. Berry at Harvard.

While certain portions of the book are at an elementary level for those who want an introduction to the subject, other portions which present new treatment of some topics such as equivalent orifice and the space-saving Gibson tapered enlargement, will be helpful to those advanced in the subject. The text is presented in a most readable style and the arrangement of topics is particularly suited where the subject must be arranged to serve readers with various technical backgrounds. Topics on which adequate information is difficult to find elsewhere are developed fully, while standard reference material is held to a minimum.

Subjects covered in Flow and Fan include: Factors in gas flow measurement, head, density, pressure, boiler draft, losses in laminar and turbulent flow through various shapes of duct, fan types and performance, fan selection and model testing.

Flow and Fan, by C. H. Berry. Cloth bound, 5½ x 8½ inches, 232 pages and 84 illustrations. Published by The Industrial Press, 148 Lafayette St., New York 13, N. Y. Price, $4.

THE LIFE OF COUNT RUMFORD

The late President Franklin D. Roosevelt once said that the three greatest minds that America produced were Thomas Jefferson, Benjamin Franklin, and Count Rumford. There is no question of the eminence of the first two, but the chances are that a very small percentage of Americans are aware of the great work of Benjamin Thompson, Count Rumford.

A biography of Count Rumford's life entitled, "An American in Europe," has now been published which should appeal to many engineers.

Count Rumford is the one who made the first determination of the mechanical equivalent of heat, invented the drip type coffee pot, attempted to develop a flame thrower, and vastly improved chimneys and fireplaces. In fact, there are today, many Rumford stoves in use in England, although the Franklin stove seems to have attracted more attention in America. He wrote a particularly interesting essay "Of the Salubrity of Warm Rooms," others on "Management of Fire," and "Economy of Fuel," and many others, some of which are reproduced in their entirety in the biography. More than any other subject, heat occupied a great deal of his attention.

An American in Europe—The Life of Benjamin Thompson, Count Rumford, by Egon Larsen. Cloth bound, 6 by 9 inches, 224 pages. Published by the Philosophical Library, New York. Price, $4.75.

• • •

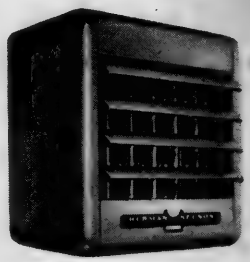
CLIMATIC DATA OF NORTH CAROLINA—Climatic Data of North Carolina for Use by Engineers, Architects and Contractors is presented in Bulletin No. 5 of the Industrial Information Series issued by North Carolina State College. This collection of data is intended to be useful to those interested in heating, air conditioning, building and construction work. Climatic information is presented by counties. Department of Engineering Research, North Carolina State College, Raleigh, N. C. Price, 50 cents.

PRESSURE LOSSES FOR SPECIAL DUCT SYSTEMS—The main duct which connects the branch ducts to the air distributor of an air condition system, or to a plenum serving these outlets can be handled in several ways of which one is a long or extended plenum with a relatively small cross section area. Takeoffs connect the extended plenum with the branch ducts. Bulletin Series No. 415 on Investigation of the Pressure Losses of Takeoffs for Extended Plenum Type Air Conditioning Duct Systems contains the results of two investigations. The first was devoted to a study of the performance of takeoff fittings for extended plenum systems and the second covered a study of the performance characteristics of extended plenum and branch duct combinations. University of Illinois Engineering Experiment Station, Urbana, Ill. Price, 50 cents.

PRINCIPLES OF ECONOMICAL HEATING—The National District Heating Association in collaboration with the National Association of Building Owners and Managers has issued the fifth edition of Principles of Economical Heating as a 45-page booklet. Explained in the text is how to operate and maintain a building's heating system to gain greater comfort with the minimum steam use. National District Heating Association, 827 N. Euclid Avenue, Pittsburgh 6, Pa. Price, 35 cents.

Some like it wet

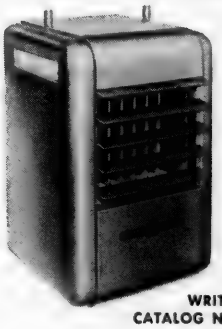
Recommend for them the Herman Nelson Horizontal Unit Heater, designed for either steam or hot water service. Made in 19 sizes . . . a complete range for every job. New Vertical Fin Assembly, working with horizontal louvers, spots or diffuses heat *anywhere* or *anyhow* you want it!



WRITE FOR CATALOG No. 700

Some like it dry

For them, install the Herman Nelson Gas-Fired Unit Heater, available in 7 sizes—job-rated for stores, lobbies, studios, warehouses, offices, salesrooms—wherever *both* beauty and efficient heating are your requirements.



WRITE FOR CATALOG No. 715

Some like it on the floor

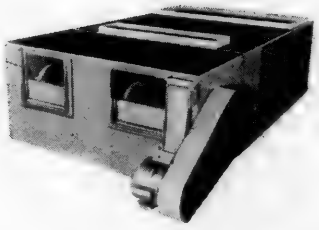
Offer those customers the handsome De Luxe Unit Heater that solves heating problems in a wink . . . works quietly and efficiently year after year, utilizing steam or hot water. Eight models in all—not only for floor installation, but also for wall, ceiling or recessed applications.

WRITE FOR CATALOG No. 725

Some like it high

This new Heating and Ventilating Unit may be hung from ceiling out of the way, or mounted on wall or floor. A quiet-operating, slow speed unit with completely rotatable fan section. Sectional type unit may be assembled many ways for all types of institutional and commercial installations.

Write for free descriptive literature . . . today!



WRITE FOR CATALOG No. 775

PLEASE 'EM ALL WITH JOB-RATED

HERMAN NELSON UNIT HEATERS

Choose From A Complete Range Of Models And Sizes

American Air Filter
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NEWS OF THE MONTH

ASHVE MEETING

held in America's most air conditioned city.
L. N. Hunter heads slate of new officers.

ASHVE held its 60th annual meeting in Houston, Texas, January 25-27, 1954. D. M. Mills was general chairman of the Committee on Arrangements for the Southwest Texas Chapter, which acted as hosts at the four-session meeting at the Rice Hotel. Themes of thirteen technical papers ran from automobile air conditioning to the availability and utilization of solar energy for heating. Abstracts of some of the papers appear elsewhere in this issue.

ASHVE President Reg. F. Taylor of Houston called the first assembly to order at 9:30 a.m. January 25 and acted in his official capacity until he turned over the gavel to his successor, L. N. Hunter, at the business meeting. High points of the business sessions were revision of a few Society by-laws, election of officers for 1954, approval of resolutions, and awarding of the F. Paul Anderson Medal to Walter L. Fleisher. Organization of the council January 28 concluded the 1954 annual meeting.

R. F. Taylor

W. L. Fleisher

• **PRESIDENT.**—Louis N. Hunter, Society president for 1954, has been a member of ASHVE since 1935. He was first vice president in 1953 and has served on many technical advisory committees.

Mr. Hunter was born in Brampton, Ont., Canada, in 1903, and received his B.A.Sc. degree from the University of Toronto in 1925. After four years as assistant research engineer with the Bryant Heater Co., Cleveland, he became gas engineer for the National Radiator Co. He was promoted to assistant manager of the Research Department in 1932, and elevated to manager three years later. He was made vice president of research in 1941, and placed on the board of directors in 1943.

• **1ST V. P.**—Members elected John E. Haines as first vice president for 1954. In ASHVE since 1940, he has been vice president and president of the Minnesota Chapter. For the last four years he has been on the Council and has acted as chairman of numerous committees.

Born in Noblesville, Ind., November 8, 1903, Mr. Haines was graduated from Purdue University in 1925 with a B.S. in Chemical Engineering. Since his graduation he has been Minneapolis-Honeywell's manager of the Modutrol Division's New York office, assistant manager of the Minneapolis Division, and manager of the National Regulator Division in Chicago. He is now in charge of the Commercial Controls Division in Minneapolis and the Appliance Controls Division in Los Angeles.

• **2ND V. P.**—John W. James, vice president in charge of research, McDonnell & Miller, Inc., Chicago, Ill., was elected second vice-president of ASHVE. Mr. James, 1953 treasurer, was former technical secretary of the Society. An ex-vice chairman of the Committee on Research, he is now on the Council's Executive and Finance Committees. He is affiliated with the Illinois Chapter, and was president of the Northern Ohio Chapter in 1947.

Born in 1907 at Brookville, Ind., Mr. James was graduated from Oregon State College in 1928. He received a research fellowship to the University of Wisconsin and earned his M.S. degree there in 1934. Before joining McDonnell & Miller, he did research and development for the Iron Fireman Manufacturing Co. of Cleveland. He was formerly associated with the engineering consulting firm of G. E. Reed of Portland, and with General Electric in Schenectady.

• **TREASURER.**—Professor E. R. Queer, director of the Department of Engineering Research, Pennsylvania State College, State College, Pa., was elected treasurer at the Society's 60th Annual Meeting. The new treasurer joined the Society in 1933, and has been an active worker on

(*Continued on page* 152)

L. N. Hunter

J. E. Haines

J. W. James

E. R. Queer

music to her ears!

A sweet note to the ears of the modern homemaker is the low, efficient hum of her automatic clothes dryer. Clothes lines, clothes pins and a damp basement full of clothes are no longer necessary.

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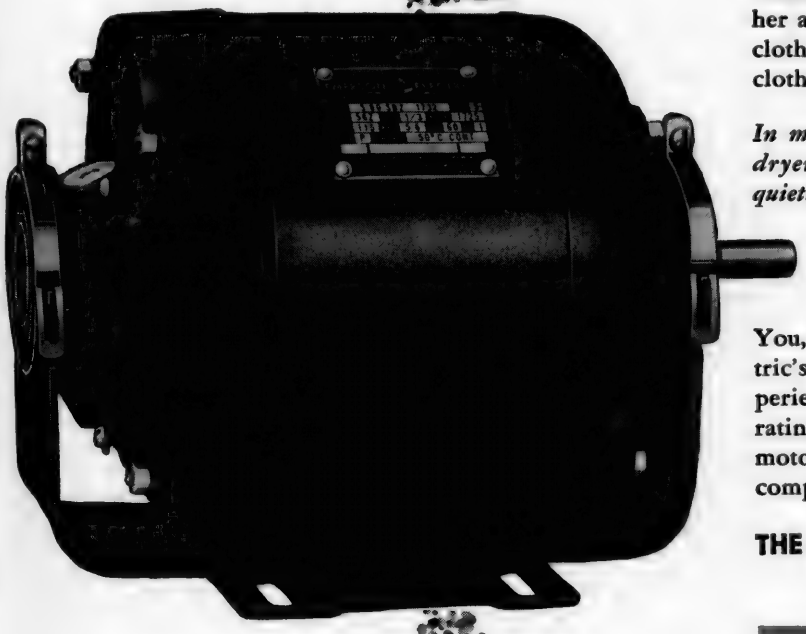

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- ☐ 487-C Integral
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- ☐ 487-E Oil-Burner
- ☐ 487-F Jet Pump
- ☐ 487-G Blower

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- **New Catalogs**

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NEW CATALOGS

OIL-FIRED SPACE HEATER—Case Study 560-84, issued by Dravo Corp., Pittsburgh, Pa., describes how oil-fired warm air space heaters helped a metal working plant obtain 6100 sq. ft. of floor area for manufacturing expansion. Also contained in the booklet are figures showing how plant heating costs were cut from 6.5 to 3.5 cents per square foot. .....Item 101

PLUMBING FIXTURE CATALOG—A new general plumbing fixture catalog, the K56, is currently being mailed by Kohler Co., Kohler, Wis., to distributors and plumbing contractors. Particularly outstanding is the practical organization of material, ease of reference and page appearance. The 148-page, 8½ by 11 inch book is bound in a cover of durable buckram. Maximum readability is assured because of the liberal use of large bold type in several styles and sizes. Tabulations are simple and easy to follow. An index provides a quick guide to the various product classifications. .....Item 102

FASTENER CATALOG—A complete, fully-illustrated, 24-page handbook, Catalog B2, describing fastening specialties is issued by Southco Division, South Chester Corp., Philadelphia, Pa. A section is devoted to each of seven different fastener types: screw fasteners, blind rivets, adjustable pawl fasteners, door latches, spring-grip fasteners, anchor nuts and door retaining springs. Each section has photographs, drawings, tables of dimensions and size, and descriptions. Item 103

NEW STEAM TRAP—A new four-page catalog, Bulletin 1153, which tells operators of steam-using units how to bring them up to maximum capacity eight times faster, is issued by V. D. Anderson Co., Cleveland, O. This catalog discusses the company's new Super-Silvertop Heat-Kwik steam traps which vent air from steam units eight times faster than ordinary inverted bucket traps. The folder states that use of these traps enables the user to obtain more production from steam units, lower steam consumption, longer trap life and a reduction in the trap capacity factor. A diagram shows how the trap obtains this fast air-venting through use of two separate orifices, one for condensate and a separate bellows orifice for air. When the trap is cold, the bellows orifice is wide open and handles large quantities of air very rapidly. After all of the air is removed through it, the bellows expands and closes the orifice. Thereafter, air is removed through the vent hole in the bucket. Since very little air now remains in the system the vent hole is of ample capacity. .....Item 104

RELIEF VALVES—Your Handbook on Temperature and Pressure Relief Valves, a pamphlet which explains and illustrates the function of relief valves, both temperature and pressure, insofar as water heaters, industrial and domestic, are concerned, is published by A. W. Cash Valve Mfg. Corp., Decatur, Ill. It touches on both AGA and ASME code requirements, and also presents recommended code requirements for cities, inspectors and plumbers. The pamphlet also lists 25 do's and don'ts for relief valve users. .....Item 105

SLIDE RULE FOR HOME COOLING—A handy slide rule for estimating season operating costs of home cooling systems is announced by Coleman Co., Wichita, Kan. Called the Coleman Economy Guide for Home Cooling, it enables the user to compute quickly and to compare what the season operating costs will be for any home in any part of the U. S. if equipped with any of four kinds of cooling systems. It covers systems with waste-water condensers, cooling towers, evaporative condensers and air-cooled condensers. The only information the user must supply to operate the slide rule is the length and width of the house; kind of insulation and shading; the amount of temperature reduction desired; local electricity and water rates. A booklet which lists utility rates in 98 cities is furnished with the slide rule .....Item 106

EXPANSION JOINTS—A new two-color bulletin No. 138 describing its expansion compensator for controlling pipe expansion in low pressure hot water or steam heating systems is issued by Flexonics Corp., Maywood, Ill. Designed for finned-type convectors, baseboard, radiator or heating supply and return lines, the compensator is suited for use in homes, office buildings, schools or other buildings where pipe expansion is present..... ...Item 107

MANUAL ON INSULATION—A 20-page technical data manual, published by American Gilsonite Co., Salt Lake City, Utah, gives engineers all available information on the application of Gilsulate, an insulation for hot underground pipes. The manual describes the company's three grades of insulation, how ditch sizes are determined for various pipes and types of soil, how the efficiency of the insulation is calculated, and how its performance for a particular job can be predicted. Charts, tables, drawings and graphs are used throughout the manual to simplify and clarify discussion of the engineer's calculations. .....Item 108

RUBBER BELTS—A new catalog on rubber transmission belting is published by The B. F. Goodrich Co., Akron, O. It describes and illustrates construction features of various industrial belts, and shows the method of making the Plylock belt joint, said to eliminate the cause of nearly all belt failures. .....Item 109

ELECTRIC HEATING FOR INDUSTRY—The 1954 edition of its catalog on Calrod electric heaters and heating devices is available from General Electric Co., Schenectady, N. Y. Designated as GEC-1005E, the 60-page, two-color catalog describes the units in terms of application, special features, installation, and pricing. More than 175 photographs and drawings illustrate the various products, including immersion, strip, cartridge, tubular, insertion, and fin heaters, melting pots, thermostats, and oven heaters. .....Item 110

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ROOM AIR CONDITIONER—A bulletin describing its Spotaire series of individual room air conditioners is issued by Drayer-Hanson, Inc., Los Angeles, Calif. Year round air conditioning, quietness, ease of maintenance, individual room control and other features are described and illustrated with photographs and charts. A page of dimensions and specifications is included. .....Item 111

LINING AND WRAPPING DUCTS—An 8-page folder on how to line and wrap residential air conditioning ducts with its Ultralite glass fiber is published by Gustin-Bacon Mfg. Co., Kansas City, Mo. Illustrated with photographs, the folder covers such subjects as when and where ducts should be lined and wrapped, when vapor barriers are necessary, accepted methods of application, and proper insulation thickness. .....Item 112

OIL COMBUSTION CONTROL—Bulletin SA 11-50 on the Type SA Robot-Eye for the control of rotary cup oil burners, and which may be used in manual, semi-automatic or fully automatic combustion control systems, is issued by Standard Instrument Corp., New York, N. Y. Item 113

VAPOR BARRIER BOOK—Recommendations for vaporsealing insulation on low temperature vessels are given in an 80-page book published by the Insul-Mastic Corp. of America, Pittsburgh, Pa. Titled Vapor and Weather Barriers for Low Temperature Installations, it contains fifty-four illustrations showing exactly where and how a vaporseal coating should be applied over thermal insulation. The purpose of such a coating is to prevent deterioration of the insulation and rusting of the vessel beneath it due to moisture and moisture vapor. .....Item 114

BLOW-OFF VALVES—A 20-page catalog, designated Bulletin B-426, on blow-off valves for boiler pressures up to 400 lb., is issued by Yarnall-Waring Co., Philadelphia, Pa. The catalog contains full details of the company's seatless blow-off valves and double-tightening blow-off valves. Additional information includes installation recommendations, construction details, and prices. .....Item 115

FREON COMPRESSORS—Freon compressors for all applications in air conditioning and refrigeration are the subject of Bulletin C-1100-B36C offered by Worthington Corp., Harrison, N. J. It describes the compressors and includes detailed cut away drawings to show the internal parts. The compressors are also shown incorporated in self-contained compressor units for use with remote condensers and self-contained condenser units utilizing shell and tube water-cooled condensers. Bulletin contains dimensions and data on all 8 models of the compressors, 8 models of the compressor units, and 8 models of the condenser units. .....Item 116

HOT WATER STORAGE HEATER—A new 48-page catalog, No. 13, is offered by the Patterson-Kelley Co., Inc., East Stroudsburg, Pa. It pictures and describes the company's line of hot-water storage heaters and presents useful information on piping arrangements and installation data. Horizontal and vertical heaters in steel, copper lined, copper-silicon, cement lined, clad and galvanized construction, as well as the low-flow design are each cataloged as to weights, dimensions, construction details and capacities. Piping diagrams are given for high and low pressure steam systems. Also included is a step-by-step guide for setting up and connecting a storage heater. Listed also are average water requirements of typical hot water fixtures in various types of buildings with examples to show how hot water requirements may be calculated and capacity requirements determined. .....Item 117

HEAT EXCHANGERS—A 16-page illustrated Bulletin No. 1000 on Paracoil heat exchangers is issued by Davis Engineering Corp., Elizabeth, N. J. The diversified heat exchanger products of this company are grouped into chemical, industrial, power plant, and marine classifications. Full technical description of the exchanger accompanies each of the more than 50 illustrations. A section on industrial oil heaters is included. .....Item 118

COMBUSTION CONTROL—A new boiler plant designed for high efficiency, easy future expansion, maximum fuel flexibility, fine appearance, and good neighbor performance is described in a detailed result story of A. B. Dick's new installation in Niles, Ill., published as Bulletin R-9 by The Hays Corp., Michigan City, Ind. .....Item 119

PACKAGED BOILERS—A new four-page folder issued by Orr & Sembower, Inc., Reading, Pa., describes Powermaster packaged automatic boilers in seventeen sizes from 15 through 500 hp for steam process as well as steam and hot water heating service. The cover of the bulletin describes the advantages of packaged automatic boilers contrasted with equipment of conventional design. Outstanding constructional and operational advantages of these units—3-pass design, forced draft, automatic controls—are described and pictured. .....Item 120

SELF-FILTERING HOODS—Details of a new-type self-filtering hood, designed for buffing and polishing wheels and belts, are publicized by Sionneger Products Co., Dayton, O., in a 4-page folder. Known as the Elim-O-Dust, the hood utilizes a new principle whereby dust is withdrawn and controlled by the air motion created by the revolving wheel or belt. The folder contains detailed design, operating and application features of the product. Drawings show component parts, supplementing detailed text on the same subjects. Charts and diagrams give a picture of the product and its operating principles. The hood is designed to remove minute amounts of dust and dirt down to 0.02 micron in size. It is claimed to save up to $800 in heat, power, maintenance and space costs in a 10-year period. Item 121

INDUSTRIAL PROCESS CONTROLS—Bulletin F-5633-1, describing the complete line of Wheelco instruments for industrial process control is made available by Barber-Colman Co., Rockford, Ill. Discussion of the company's electronic link is featured. It is a no-contact linkage between the direct measuring unit and the automatic control and recording system which gives instantaneous control and recording action. Also included in the new bulletin is a description of the Flameotrol, the heart of the company's system of combustion protection. .....Item 122

LEVELING MOUNTS—A brochure describing the advantages of its leveling Barrymounts is available through the Barry Corp., Watertown, Mass., manufacturers of shock and vibration isolation equipment. Advantages of the LM-3 and LM-5 series of mounts, such as installation and leveling of heavy machines without bolting or shims, increased plant mobility, reduced maintenance costs and lessening of the noise level are revealed in detail, with photographs. .....Item 123

FILM ON RADIANT HEATING—A new 16-mm. sound, color film, The Story of Radiant Heating, is released by Chase Brass and Copper Co., Waterbury, Conn., for showing to wholesalers of plumbing and heating equipment, heating contractors, engineers, architects, and builders. It is available on loan. .....Item 124

AUTOMATIC CONTROLS—Bulletin No. 2b-Me is issued by the Mercoid Corp., Chicago, Ill., to describe its series D controls for industrial applications requiring positive control of pressure, vacuum, temperature and liquid level. A section of the condensed catalog is devoted to transformer relays, water proof housings and explosion-proof control housings. Each item is illustrated with a photograph and charts are included where required. .....Item 125

PULPIT AIR CONDITIONER—Bulletin No. 1207, published by Dravo Corp., Pittsburgh, Pa., describes a pulpit air conditioner designed for use in industrial control areas where heat, dirt or fumes create hazardous working conditions. The 4-page booklet lists mechanical features of the conditioner, and presents tables of capacities and dimensions of evaporator and condenser sections. .....Item 126

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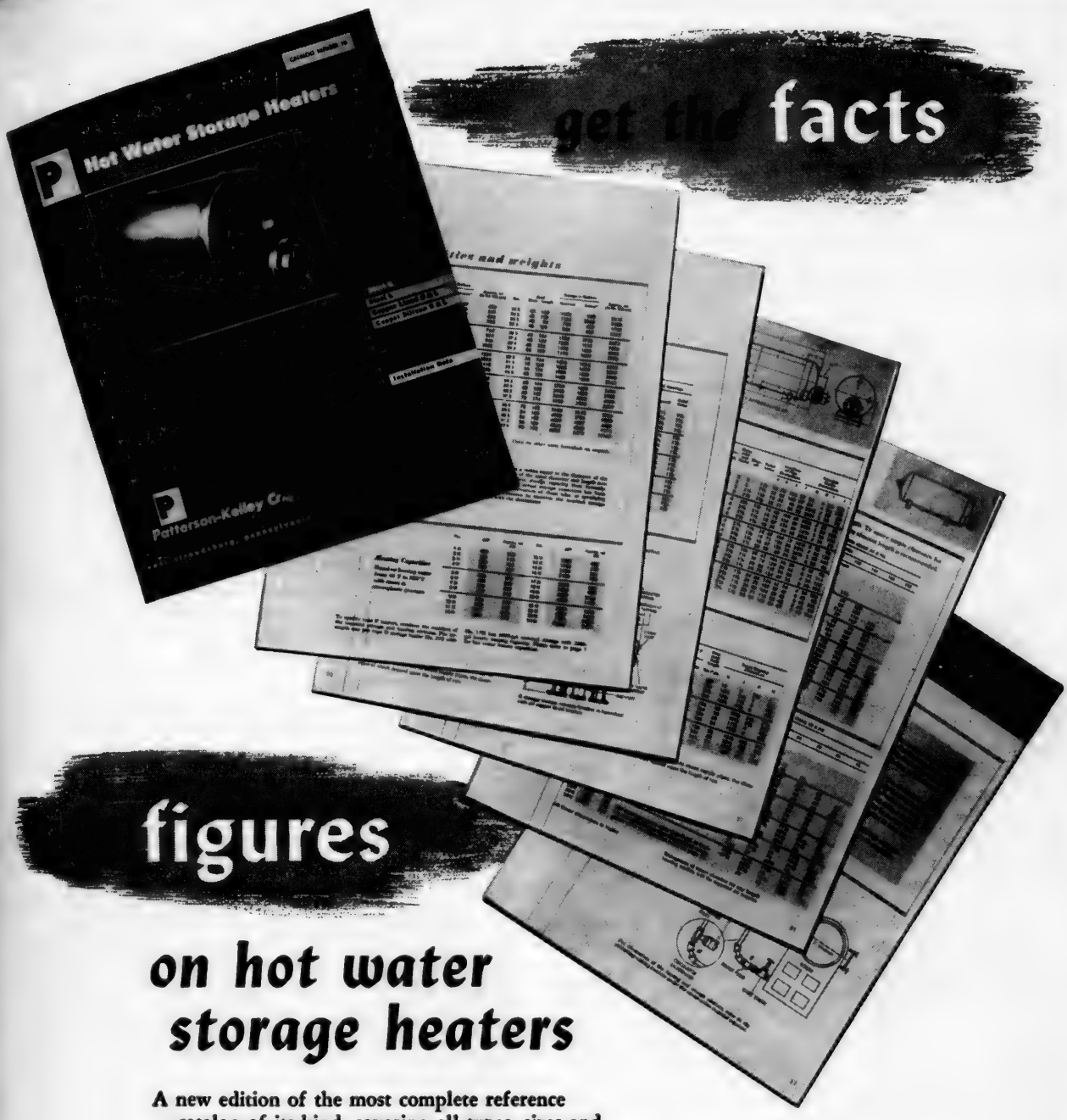

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ASHVE MEETING

(*Continued from page* 148)

many of its committees. He is a member of the Council, also its Finance and Ways and Means Committees.

Professor Queer was born in Johnson, Pa., in 1904 and attended Penn State College, receiving his M.S. degree in 1928. Since graduation he has engaged in engineering research for the college. He is also consultant to the Chief of Army Ordnance, the Bureau of Yards and Docks of the Navy, and the Pittsburgh Lectrodryer Corp.

• **COUNCIL.**—The following members were elected to three-year terms on the Society Council: C. H. Pesterfield, associate professor of mechanical engineering, Michigan State College, East Lansing; B. H. Spurlock, Jr., professor of mechanical engineering, University of Colorado, Boulder; John H. Fox, sales manager, Minneapolis-Honeywell Regulator Co., Ltd., Toronto, Ont., Canada; and A. J. Hess, president, Hess-Greiner & Polland, Los Angeles.

ATOMIC ENERGY

nears goal of civilian applications for power and heating of buildings.

Completion of the world's largest steel sphere, for housing a test atomic power plant, and development of a plan for utilizing heat from atomic energy to warm buildings for the first time in the United States, topped General Electric activities in the atomic field in 1953.

A summary made by G. E. atomic boss Francis K. McCune also listed among the company's major accomplishments continued increase in production of plutonium along with a further decrease in its cost to the U. S. taxpayer.

• **PROJECTS.**—The company's vast atomic activities, operated for the Atomic Energy Commission, are the largest in industry, he said. They include the Hanford Atomic Products Operation, at Richland, Wash., which, on a site half the size of Rhode Island, produces plutonium for atomic bombs; the Knolls Atomic Power Laboratory in Schenectady, currently developing atomic submarine engines; and the Aircraft Nuclear Propulsion Department, at Evendale, Ohio, which is developing atomic engines for aircraft.

• **MOTIVE POWER.**—The world's largest steel sphere, 225-feet in diameter and rising as high above the ground as an 18-story building, was completed in October at West Milton, N. Y. Made of 3850 tons of inch-thick steel plates, this great ball will house the prototype atomic power plant for the U. S. Navy's submarine, Sea Wolf. The prototype plant will be assembled inside an actual section of submarine hull, which has been built alongside the sphere. A temporary hole will be cut in the ball to enable the hull section to be skidded inside, said McCune.

In the meantime, he added, the Sea Wolf itself is being constructed by the Electric Boat Division of the General Dynamics Corp. in their Groton, Conn., shipyard. The keel of this vessel was laid last September.

• **HEAT.**—Two other important steps are now under way at Hanford toward utilization of atomic energy, he said. Heat from new reactor facilities, now being built, will be utilized in the reactor building itself and adjacent structures. This will be the first extensive use of atomic by-product heat in the country.

In addition, thermal atomic energy is being employed at Hanford in concentrating highly radioactive wastes from the reactors, he pointed out. These wastes are stored in underground tanks, and the solvent is boiled off in order to minimize storage space. Previously this was accomplished by steam heat, but now use is made of heat generated by the radioactive decay of the waste elements themselves, he added.

• **NEW LAB.**—Among other Hanford developments, he cited the completion during 1953 of a new $14 million laboratory area with facilities for work with radiation and radioactive materials in the fields of chemistry, metallurgy, physics, engineering and biophysics, employing about 600 people. This brings to about $30 million the total spent on research and development at Hanford in the seven years of G. E. operation.

• **PENN STATE REACTOR.**—The U. S. Atomic Energy Commission has approved the allocation of fissionable material as fuel for a nuclear reactor to be built by Pennsylvania State University.

The low-power "swimming pool" type reactor will be operated for nuclear research and for the training of students. It is the second privately owned reactor for which the AEC has authorized the use of nuclear fuel. The first, built by the Consolidated University of North Carolina, began operation last September 5.

The Pennsylvania State University reactor will be constructed and housed on the university campus for an estimated $250,000 to $300,000. The cost of construction and operation will be borne by the university, without financial assistance from the AEC. The reactor will operate at a power level of 100 kilowatts. It will be cooled and moderated with ordinary water, and will use enriched uranium fuel. The fuel elements will be suspended in a pool of water sufficiently deep to serve as a shield against the radiation produced by the reactor.

A similar "swimming pool" facility, the Bulk Shielding Test Reactor, has been in operation at Oak Ridge National Laboratory since 1952. Experience with the Bulk Shielding Test Reactor has demonstrated that this type of reactor is inexpensive, safe to operate and easy to maintain.

• **LONDON.**—Britain stripped away much of the secrecy from her atomic energy program in a statement which said she was producing advanced nuclear weapons and hoped to generate all the nation's electricity by atomic power within twenty years.

The nation's progress in the field of nuclear energy was outlined in a booklet entitled "Britain's Atomic Factories," published by the Official Stationery Office.

• Promotion of J. A. Hallinan to assistant sales manager, Pacific Boiler Division of United States Radiator Corp., has been announced. For many years Mr. Hallinan served in key positions in the company's Cyclotherm Division.

(*More news on page* 154)

Move Air or Fumes ECONOMICALLY with new PORTOVENT* Ducting

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This new spiral-wire reinforced ducting has many features which can mean savings in time and money.

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Portovent is made with Nylon base (Type SY) or cotton base (Type SC). Both are impregnated with age-resisting Neoprene compound.

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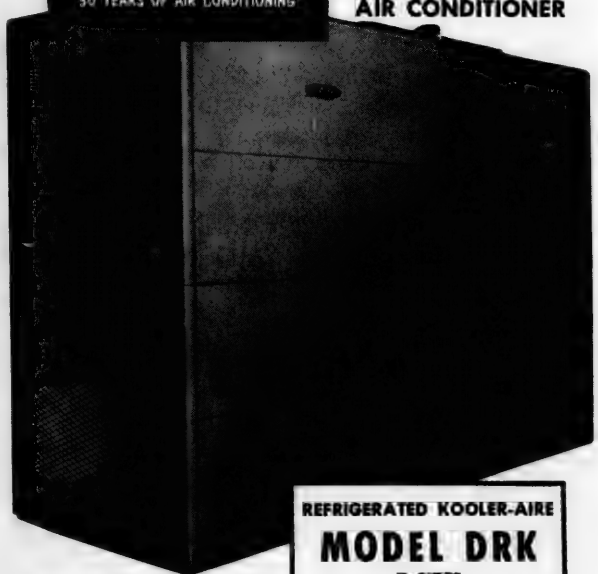

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USAIRCo's DRK combines 2 separate refrigeration circuits two compressors, two motors, cooling section and evaporative condenser in one central station. One or both compressors operate automatically depending upon load requirements. Separate refrigeration circuits permit continued dehumidification when operating at reduced capacity.

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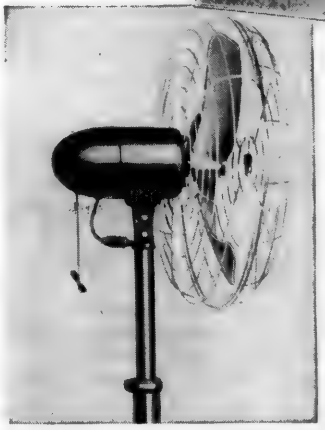
Airmaster roof exhauster powered by Doerr motor. Top hood and louvers not shown.



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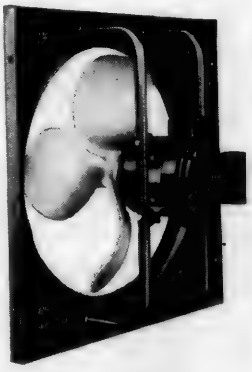

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ANTHRACITE REGION

acts to spur jobs as hard coal production lags. Leaders urge federal aid to cut costs.

Leaders of the northeastern Pennsylvania anthacite region are calling for a "united and comprehensive program" to relieve its unemployment crisis.

• **TASK FORCE.**—They appointed an "economic task force," a five-man commission to substitute "positive action" for the region's long contention that it "should receive governmental and state aid because it is a chronic distressed area."

Two hundred leaders of the region, which covers more than 480 square miles from Forest City to Pottsville, participated in the "emergency session" called by the Northeastern Pennsylvania Industrial Development Commission.

• **11% JOBLESS.**—Victor D. Diehm of Hazleton, president of the sponsoring commission, told the gathering, which included representatives of all segments of the area's economy, that unemployment, mainly from mine shutdowns, had risen to about 42,000, or 11 percent of the working force in Schuylkill, Carbon, Luzerne, Lackawanna and Northumberland Counties.

In reporting that hard coal output and employment had slumped to the lowest levels since 1880, W. J. Clements, secretary of the Pennsylvania Department of Mines, declared that "drastic action must be taken if the anthracite industry is to be preserved."

• **PRODUCTION.**—Production dropped to 30,534,000 tons last year, against 39,924,000 tons in 1952, and the force of working miners dwindled from 58,341 to 48,914.

With the cut in the spending power of miners, thousands of others, including mechanics, clerks, railroad workers and salesmen, have been laid off, and unemployment compensation claims have risen sharply throughout the five-county district.

• **DRAINAGE.**—Mr. Clements urged a request to Gov. John S. Fine to appoint a committee to put the area's plight before President Eisenhower. He also suggested that, pending Government action on the proposed 170-mile, $350 million mine drainage tunnel to extend from Olyphant to Conowingo, the program for sealing of mines should be expanded.

If the Government would provide $15 to $20 million for such work, Mr. Clements said, "it would result in providing jobs, relieve water conditions, improve watersheds, improve the appearance of communities, eliminate danger conditions and reduce the cost of anthracite production."

He stressed that sealings would reduce the need to pump water out of mines. An average of thirty tons of water must now be pumped from a mine to produce one ton of coal, he said, and this added $1 a ton to the cost of the coal.

The retail prices of coal at the mines in this section are $13 a ton for pea, $16.70 for nut and $17 for stove. Elsewhere, the price varies with distance. In Philadelphia, with hauling charges added, prices average $16 a ton for pea and $19 for nut and stove.

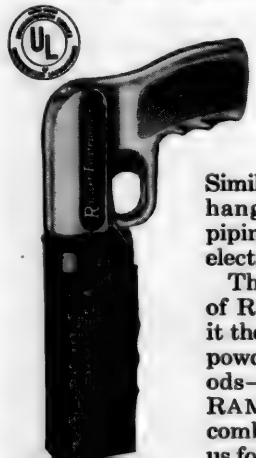
The task force will study proposed projects and line them up with the resources of the region, such as uranium deposits and available labor force.

Ramset FASTENING SYSTEM SAVES $11,000

for Fastening Air Ducts in Texas' Largest Store

More than two miles of air conditioning ducts were installed with RAMSET SYSTEM in the new addition to Joske's Department Store at San Antonio, Texas, the "largest store in the largest state."

By using RAMSET Jobmaster, anchoring studs were set at the rate of better than 1 per minute, instead of an estimated 15 minutes each by old-fashioned, conventional methods. Substantial cost savings were thus gained, as well as a far faster, completely secure installation. Similar results were obtained for hanging 13 miles of sprinkler piping and anchoring 43 miles of electric conduit.



The high speed and wide utility of RAMSET SYSTEM have made it the 2-to-1 favorite over all other powder-actuated fastening methods—and more contractors use RAMSET than all other makes combined. Ask your dealer or write us for details on how you can make more profit from every job by using RAMSET SYSTEM.

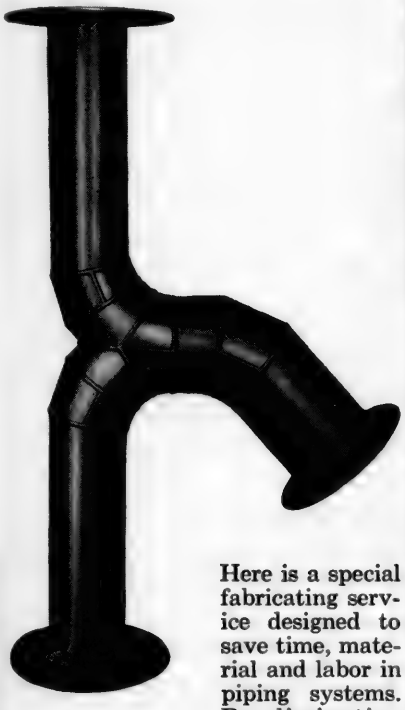
Ramset Fasteners, INC.

Ramset Division, Olin Industries, Inc.

12135 BEREA ROAD • CLEVELAND 11, OHIO

FIRST IN POWDER ACTUATED FASTENING — AN Olin PRODUCT

HOW TO SAVE MATERIAL and LABOR IN PIPING LAYOUTS



Here is a special fabricating service designed to save time, material and labor in piping systems. By eliminating numerous flanged joints and combining several fittings into one integral unit, as illustrated, Naylor fabrications provide the answer for greater efficiency and economy.

All types of materials can be fabricated accurately to your specifications. Sizes range from 3" to 44" in diameter and wall thicknesses up to ⅜".

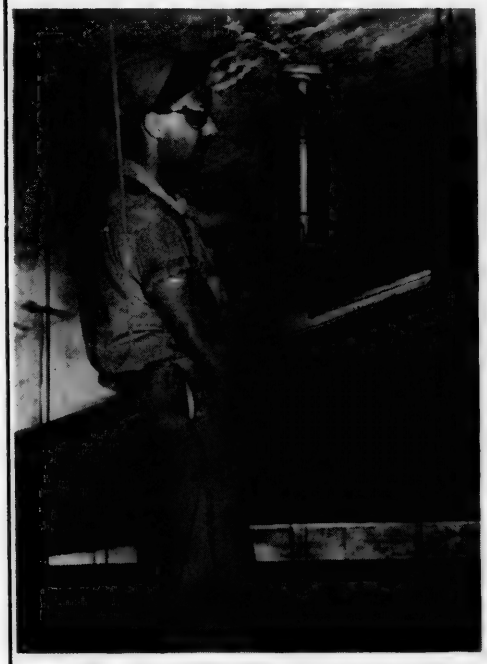
Naylor Bulletin No. 525 presents helpful information on this special service. Write for your copy today and submit your problem for recommendation and quotation.

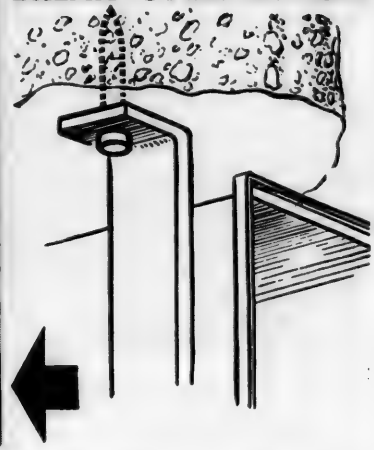
NAYLOR PIPE

Naylor Pipe Company
1265 East 92nd St., Chicago 19, Illinois
Eastern U.S. and Foreign Sales Office
350 Madison Ave., New York 17, N.Y.

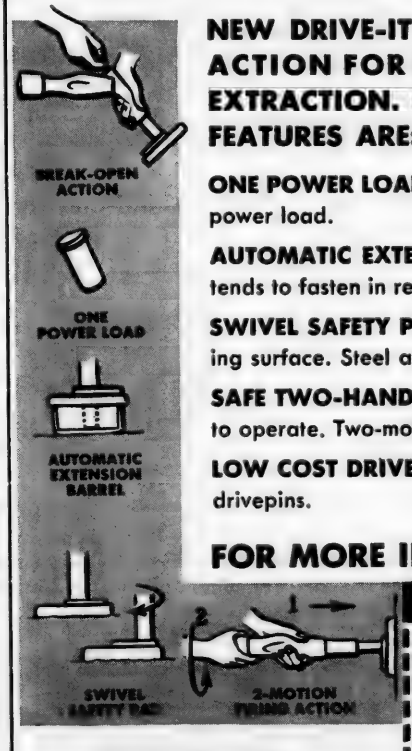
ANCHOR DUCTWORK TO CONCRETE FASTER

DRIVE-IT 320 WITH BREAK-OPEN ACTION





The ventilating ductwork in this large Ohio manufacturing plant was fastened to concrete with *DRIVE-IT* powder-operated fastening system. All types of concrete or steel fastenings can be speeded with *DRIVE-IT*—strap hangers, pipe hangers, conduit clamps, furring strips, and hundreds of other items.



NEW DRIVE-IT 320 FEATURES BREAK-OPEN ACTION FOR FAST, EASY LOADING AND EXTRACTION. OTHER JOB-PROVED DRIVE-IT FEATURES ARE:

ONE POWER LOAD. Variable penetration with one strength power load.

AUTOMATIC EXTENSION BARREL. Integral with tool. Extends to fasten in recesses.

SWIVEL SAFETY PAD. Swivels 360° to fasten near adjoining surface. Steel and tough Neoprene for protection.

SAFE TWO-HAND FIRING. Tool must be held against work to operate. Two-motion firing action for safety.

LOW COST DRIVEPINS. Prices are lower on wide range of drivepins.

FOR MORE INFORMATION

DRIVE-IT
the original
POWDER-ACTUATED TOOL

MAIL THIS COUPON

POWDER POWER TOOL CORP.
7526 S. W. Macadam Ave., Dept. A
Portland 1, Oregon

☐ Please send literature on DRIVE-IT "320"
☐ I'd like a demonstration of DRIVE-IT "320"

Name_____

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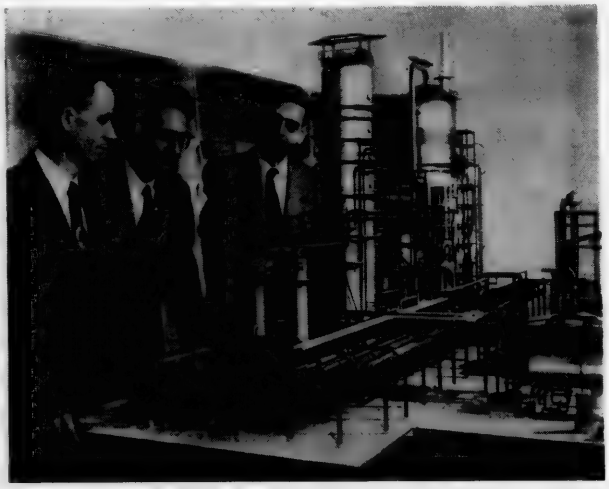
CAT CRACKER MODEL



THREE-DIMENSIONAL BLUEPRINT:—That's what this model is called by engineers and field construction workers now building one of the largest catalytic crackers in the world at Shell Oil Company's refinery at Norco, Louisiana. With a total feed of 72,000 barrels per day, the cat cracker will be Shell's biggest when it is completed next year. This model, eight feet long, four feet wide and three feet four inches high, is on an exact scale of ¼ inch to one foot. H. H. Wanderman, builder of the model, points out some of its features to H. E. Henslee (left), of Foster Wheeler Corp., builders of the unit, and H. L. Isham, Shell engineer.

LUNG CANCER

may be related to air pollution, especially to coal and petroleum fumes, evidence shows.

Evidence relating the incidence of lung cancer to air pollution continues to pile up, although there has been no conclusive demonstration of actual causative agents in air. The situation has been summarized by Sheldon Binn in the New York World-Telegran and Sun. He points out that the evidence against city air with its coal smoke and petroleum fumes is much more convincing than recently publicized evidence against cigarette smoke.

• **HERE'S WHY.**—A cancer-producing chemical, formed by the incomplete combustion of coal and petroleum products, has been found in the air of various English cities. The chemical (3,4-benzpyrene) is known to cause skin cancer in humans and skin and lung cancer in laboratory animals. It is not known positively whether benzpyrene will cause cancer if inhaled by human beings.

It is one thing for a chemical to be rubbed into the skin continually and quite another for it to be inhaled into the lungs, which are constantly bathed in fluid.

The human evidence against benzpyrene actually was noted nearly 200 years ago. Chimney sweeps in London were contracting skin cancer at an alarmingly high rate. The blame was placed on the coal tar, which condensed inside the chimneys and accumulated along with soot.

(*Continued on page* 158)

The MASSACHUSETTS Line®

If YOU build a better one.....

It's an old chestnut and the world is not beating a path to our door BUT we DO have a better line of . . .

HEATING and VENTILATING EQUIPMENT

PROPELLER FANS
New Venturi-type Belt drive 24" to 48" wheel diameters, direct drive 12" to 30" diameters.
A complete line of accessory items are available.
Write for Bulletin No. 117

POWER ROOF VENTILATORS
Propeller Fan type available in six sizes direct driven and five sizes belt driven, and features the Venturi-type orifice.
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MASSACHUSETTS BLOWER DIVISION
The BISHOP & BABCOCK Mfg. Co.
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ONE doesn't fit ALL needs!

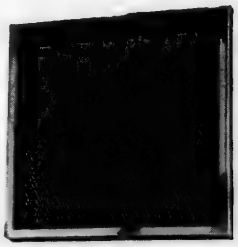
Get *Airsan* Filters
ENGINEERED TO FIT THE JOB — RIGHT EVERY TIME

No filter does all jobs, meets every need. That's why Airsan Filters are engineered to the job to offer more effective dust collection. Airsan's expanded metal face plate acts as a lint arrestor to provide easier cleaning and servicing. It distributes air easily over the entire filter area. Provide high filtering efficiency and dust holding capacity with less resistance. Features include all galvanized construction and welded lock corners. Write for data.

Send for Free Bulletins

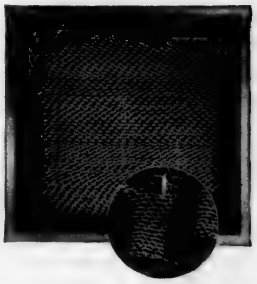
AIR FILTERS
(Low Velocity)

Viscous type, permanent and cleanable designed for industrial, commercial and domestic use. Available in 1" and 2" thickness.



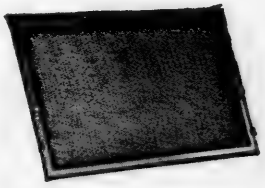
VIRO-CRIMP
(High Velocity)

Has a specially designed high velocity Viro-Crimp filter core. Hemmed edges provide a safety feature. Operates efficiently at 300 to 500 fpm. Available in 2" and 4" thickness.



GREASE FILTERS

Permanent, cleanable type Airsan Grease Filters made especially for range canopies, galleys, kitchens. Available in 2" thickness.



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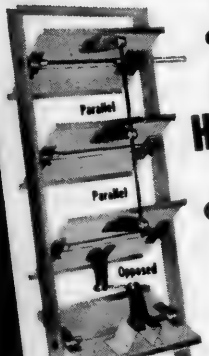
SAVE TIME, MONEY and MAINTAIN TOP QUALITY *DURO-DYNE* PRODUCTS

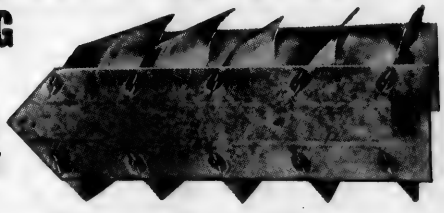
"DURO-BLADE KIT"
precision engineered DAMPER HARDWARE



- Swiftest, simplest assembly
- Ideal for light or heavy dampers, 3" blades or wider
- Corrosion-resistant throughout
- Parallel or opposed blade action
- Can be screwed, bolted, riveted, welded, spot welded

"DURO-VANE RAIL"
new, speedy, accurate way to make engineer-approved AIR TURNING VANES

Installed Cost cut 50% to 70%



- Completed Turning Vanes meet engineering specifications
- Duro-Vane Rail lies flat in duct
- Eliminates layout
- Shipped bundles of 8 ft. rails, including special broad point chisel

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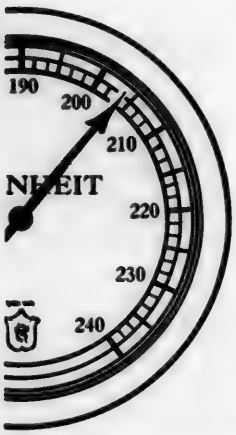


if high fuel oil temperatures are what you need—the Paracoil TYPE "GF"*

INDIRECT GAS FIRED FUEL OIL HEATER is the answer!

With sub-water-line oil heaters, a low circulating boiler water temperature can play havoc with even the best engineered No. 6 oil burner layouts—particularly with the viscous oils now being used!

Our Type "GF" Indirect Gas Fired Heater can give you any desired oil temperature you want—without the use of expensive electric boosters!

APPLICABLE TO ALL TYPES OF OIL FIRED APPARATUS!

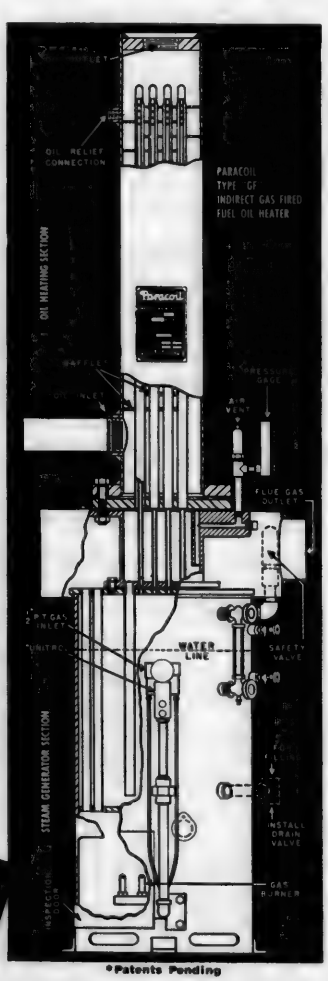
As it is not dependent upon the unit it is servicing for the means of heating the oil, the Type "GF" Heater can be applied to any oil fired apparatus, be it a steam or hot water boiler, a process oven, a dryer or a kiln!

ONE HEATER CAN SERVE MANY BURNERS!

No steam piping required. Heater operates on a closed, internal steam and condensate cycle!

CHECK THESE FEATURES!

Completely factory assembled • Easy to install anywhere, even outdoors • Requires only minimum of floor space • Economical to operate • Wide range of oil heating capacities • Burns any specified type of gas fuel • High oil temperatures at all times • Operation unaffected by normal variation in viscosities of oils being heated.



*Patents Pending

Write today for BULLETIN 60-L

Approved by Board of Standards and Appeals City of New York

DAVIS ENGINEERING

CORPORATION

1064 EAST GRAND ST., ELIZABETH 4, N. J. • 30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

LUNG CANCER

(*Continued from page* 156)

Later work by modern chemists named the offender in the coal tar as benzpyrene and then the evidence started pouring in.

This is some of the more dramatic evidence:

(1) An analysis of death certificates by Dr. Percy Stocks of England showed the number of deaths from lung cancer in English towns increased in proportion to the number of chimneys per acre.

(2) Lung tumors were produced in mice allowed to breathe soot collected from the air of an English city.

(3) The U. S. Public Health Service found that cancer could be produced in animals by extracts of tarry matter collected from the air of eight different U. S. cities.

(4) The New York City Department of Health showed that 176 tons of solid matter, including half a ton of tarry material, settled out of the air onto every square mile of Manhattan every month.

(5) The English scientist, Richard Doll, discovered that among 840 gas workers (coal is burned to produce manufactured gas) the lung cancer death rate was double the normal rate. The possibility of this occurring by mere chance is 100 to 1.

• **OIL.**—But belching chimneys are not the only culprits being charged with slow homicide.

Three months ago Dr. Paul Kotin, assistant professor of pathology at the University of Southern California, declared that his research into the exhaust products of gasoline and Diesel engines showed they contain cancer-producing chemicals, including our old enemy, benzpyrene.

These exhaust extracts, when painted on mice, produced skin cancers in 50 percent of the animals.

Next time you see a bus spewing forth a cloud of blue smoke, keep this in mind. Dr. Kotin said his studies showed that a smoking engine produced every minute 200 times the amount of benzpyrene necessary to cause fatal cancer in a mouse.

What is of particular interest to city dwellers is Dr. Kotin's finding that far more cancer-producing chemicals are loosed into the atmosphere by inefficient and slowly running engines (such as they do in New York's heavy traffic) than by engines in good operating condition or those running at moderate speeds.

Dr. Kotin told a meeting of the American Cancer Society the following:

"The increasing frequency of lung cancer in cities as compared with rural areas all over the world indicates that the atmosphere may be the principal cause of the disease."

But even the statistics have unsolved mysteries. It is known that cancer is killing four times as many men and twice as many women as it did in 1933. But while the rate of lung cancer in white males in urban states is two and a half times greater than the rural ones, the urban-rural difference for females is almost negligible.

• **ENGINEERING.**—Dr. William E. Smith, former chairman of the Cancer Prevention Committee and currently of New York University's Institute of Industrial Medicine, sums it up this way:

(*Continued on page* 160)

LOW PRESSURE SYSTEM *Condensate Pumps*

SINGLE UNIT—Fig. 302A
10 Gal. Receiver for Single Units
Diameter 21"
Hgt. of Return above floor 6⅞"

Capacities 500 to 10,000 sq. ft. E.D.R.

weil TVC PUMP

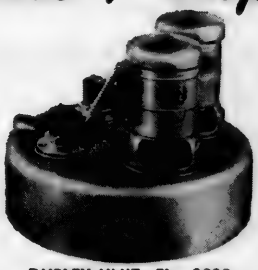
LOW RETURN CONNECTION

LOW SPEED, LONG LIFE

CAST IRON RECEIVER

LOW WATER LINE

ELECTRODE OR FLOAT SWITCH CONTROL



DUPLEX UNIT—Fig. 303B
15 Gal. Receiver for Single or Duplex Units
Diameter 25½"
Hgt. of Return above floor 7⅜"

TVC SELECTION TABLE

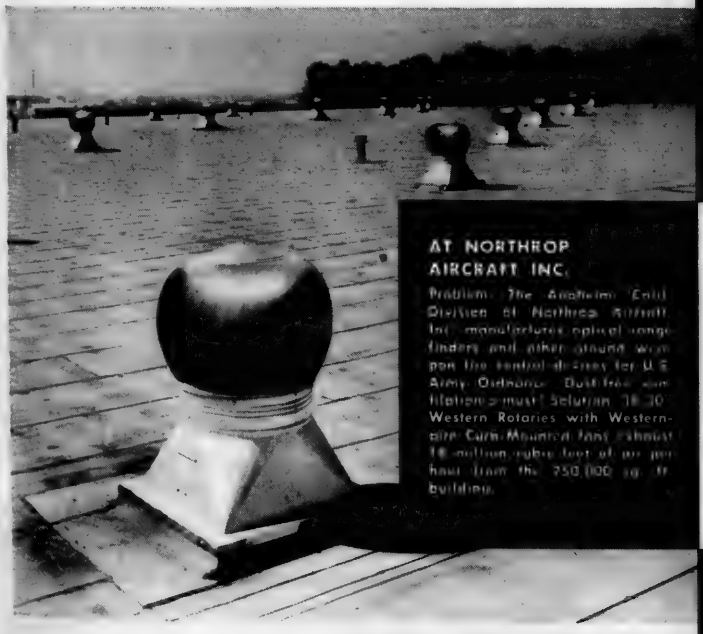
Unit Number	Max. Sq. Ft. E.D.R.	Discharge Pressure At Pump	G.P.M. From Radiation	Cap. of Pump	H.P. of Motor	Return Inlet	Pump Discharge	Dia. of Receiver	Height of Unit
TVC 13	500	20 lbs.	.25	1.0 GPM	1/4	2"	1"	21"	21"
TVC 19	750	20 lbs.	.38	1.5 GPM	1/4	2"	1"	21"	21"
TVC 23	1000	20 lbs.	.5	1.5 GPM	1/4	2"	1"	21"	21"
TVC 29	2000	20 lbs.	1.0	3.0 GPM	1/4	2"	1"	21"	21"
TVC 35	4000	20 lbs.	2.0	6.0 GPM	1/4	2"	1"	21"	21"
TVC 41	6000	20 lbs.	3.0	9.0 GPM	1/2	2"	1"	21"	23½"
TVC 47	8000	20 lbs.	4.0	12.0 GPM	1/2	2"	1"	25½"	23½"
TVC 52	10000	20 lbs.	5.0	15.0 GPM	3/4	2"	1"	25½"	27½"

See Bulletin TVC-300-C for Full Specifications

Intermediate Sizes Based Upon Discharge Pressure Required Are Available.

weil PUMP CO. 1516 NORTH FREMONT ST., CHICAGO 22

Where the problem is ventilation — the solution is a WESTERN SYSTEM



AT NORTHROP AIRCRAFT INC.

Problem: The Anaheim Field Division of Northrop Aircraft, Inc. manufactures optical range finders and other ground work gun fire control devices for U. S. Army Ordnance. Dust-free air, lifetime equipment. Solution: 38-30 Western Rotaries with Western-aire Curb-Mounted Fans exhaust 18 million cubic feet of air per hour from the 350,000 sq. ft. building.

AT YOUR PLANT

Western Rotary ventilators, with or without fans, can do the most for you. A 2 mph wind operates the Western Rotary—and it continues to exhaust during wind lulls due to superior balance design. Years of trouble-free performance—bearings carry lifetime guarantee. Check Sweet's or AEC for high exhaust capacity figures. Then specify Western—a first-rate line of rotary, stationary, continuous ridge, directional ventilators and exhaust fans. Handled by wholesalers coast to coast.

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Write for catalog, or tell us your special installation problems.

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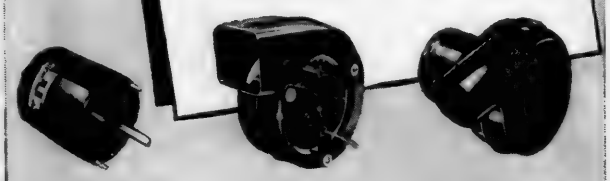
The latest developments in electric motor design. Smooth-running motors built for long life . . . with outstanding Tri-Flux and Uni-Cast features.

A wide selection of motors in sizes from 1/500 to 1/6 h.p., and blowers from 50 to 280 CFM.

25 years of experience, specializing in efficient motor design while making no end product to compete with its customers.

Let a Redmond Sales Engineer help you select the right motor for your application. Write today for information.



• 25th Anniversary •

Redmond
COMPANY, INC.
OWOSSO, MICHIGAN

Western Area Office: 1260 So. Boyle Ave., Los Angeles, Calif.

LUNG CANCER

(*Continued from page* 158)

"I am convinced that a great deal of cancer prevention depends not on medical means but on engineering procedures and public awareness of the need for preventing contact with cancer-producing chemicals. The constant heavy pollution of the city's air with soot is an example of a preventable hazard."

• **EXAMPLE.**—He cited the fact that "yellow fever and malaria were brought under control by sanitary engineering measures to eliminate mosquitoes which carried those diseases.

"Typhoid has been controlled by cleaning up water and milk supplies. There is good evidence to show that engineering can contribute to the prevention of some forms of cancer."

And while all the evidence is not in on the exact part and degree to which air pollution plays a part in the cancer story, look at it this way:

Would you knowingly breathe in anything that could cause skin cancer but which nobody had proved could cause lung cancer?

COAL CONVEYOR

carries 800 tons per hr on 4½ mile rubber belt, one of world's longest.

Coal obtained from a strip mine near Beverly, Ohio, now is riding over one of the world's longest permanent rubber conveyor belt systems.

The conveyor system is located on an isolated, wooded, rolling tract five miles northwest of this quiet southern Ohio community. Installed by The B. F. Goodrich Company, Akron, O., the rubber belt transports 800 tons of coal per hour over a four-and-one-half-mile twisting, up-hill-down-dale course from strip mine to coal storage area on the bank of the Muskingum River. To reach its destination, the beltroad bridges county roads, spans a state highway and crosses the 500-foot wide Muskingum.

• **POWER.**—Coal carried by the conveyor system serves as a source of fuel for The Ohio Power Company's new 400,000-kilowatt Muskingum River Plant, located on a 108-acre site on the west side of the river near Beverly. Ohio Power now has substantial coal reserves which can feed its new conveyor system for a number of years.

The entire conveyor system is composed of 14 flights, or sections, of rubber conveyor belting, ranging in length from 500 feet to 2,964 feet, pulley to pulley distance. The belts, all products of B. F. Goodrich, are 36 inches wide and travel at a speed of 600 feet a minute. Highest incline angle traversed is 12 degrees; greatest decline is 12 degrees. Transfer points located where one belt flights ends and another begins automatically cause the coal to discharge from one belt to another.

As the coal is mined, it is loaded by electric shovels into Euclids, which transport it to a preparation plant, where the coal is crushed and washed. Emerging from this process, the crushed coal is ready for its roller-coaster journey to the river stockpiling area.

RIGIDBILT STEAM DISTRIBUTING TUBE HEATING COILS

"SD" Coils are fabricated from the same heavy fin stock, casings, etc., and to same high quality as Rigidbilt Standard Steam Coils.

For heating jobs where regulated steam control is needed, RIGIDBILT Steam Distributing Coils are ideal. Uniform steam distribution is provided throughout entire length of coil, even when low throttled. Coils consist of 2 separate sets of tubes, one within the other, spaced by separators, and each free to expand or contract. Special construction keeps condensate warm.

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RIGIDBILT INC.

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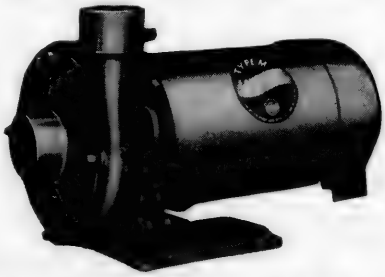
FAST DELIVERY!

AIR CONDITIONING & VENTILATING UNITS • UNIT & PRODUCT COOLERS • HEATING & COOLING COILS
ALSO COILS DESIGNED AND BUILT FOR SPECIAL APPLICATIONS

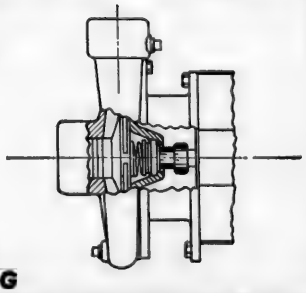
LANCASTER



UNIT PUMPS - TYPE M

For Air Conditioning and Circulation

Exclusive all brass intermediate shaft design prevents corrosion, eliminates costly repairs, keeps a Lancaster on the job year after year.



¼-H.P. to 5-H.P.
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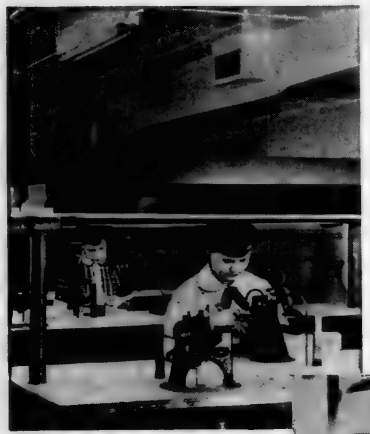
LANCASTER PUMP and MFG. CO., INC.
LANCASTER, PENNSYLVANIA

Only ADSCO's exclusive features make maintenance so easy. There's no breaking of pipe connections to inspect or service the trap, because all working parts are mounted on the cover. An extra cover assembly becomes a complete spare trap . . . replace the cover in a matter of minutes, service the original, and the result is a spare trap always ready.

ADSCO traps offer additional exclusive advantages: reversible stainless steel valve and seat double the life of the trap . . . inlet and outlet connections on *both* sides make installation easy and less expensive. Write today for catalog data.

AMERICAN DISTRICT STEAM COMPANY, INC.
GENERAL OFFICES
NORTH TONAWANDA, NEW YORK
PLANTS: NORTH TONAWANDA, N. Y., AND RICHMOND, CALIF.

You can have DRY AIR with exact moisture control..



Assembling Electronic Parts

FOR YOUR COMFORT

FOR YOUR PROCESS

FOR TESTING MACHINES OR MATERIALS AT ANY TIME OF THE YEAR

Packaging Food Products

● This Niagara "Controlled Humidity" method gives you the **MOST EFFECTIVE** Air Conditioning because its cooling and heating functions are made completely separate from adding or taking away moisture. This assures you always a precise result. No moisture sensitive instruments are needed.

MOST FLEXIBLE. You can reach and hold any condition in response to instrument settings, or vary it as you wish.

Drying Industrial Material

EASIEST TO TAKE CARE OF. The machine is accessible, the control circuits are simple and easy to operate, and there are no solids, salts or solutions to be handled.

MOST COMPACT. It does a very large amount of work in a small space.

INEXPENSIVE TO OPERATE. At normal atmospheric temperatures (unlike systems that use refrigeration to dehumidify) it needs no summer re-heat.

Write for Bulletins 112 and 122

NIAGARA BLOWER COMPANY

Dept. HV, 405 Lexington Ave. New York 17, N. Y.

Niagara District Engineers in Principal Cities of U. S. and Canada

WATER SHORTAGE

designed out of new air conditioned communities by plan for central spray pond and pumping station.

At a recent meeting of water works officials from several New Jersey municipalities and Worthington Corp. air conditioning experts, plans were discussed for alleviating water shortages by expanding communities. In some New Jersey areas, as well as in other parts of the country, seasonal droughts have presented an acute problem in water conservation particularly where air conditioning of private homes is involved. Some of these communities found it necessary to curtail the consumption of water for air conditioning purposes during the prolonged dry, hot spell this past summer.

• **POND.**—Worthington's vice president in charge of air conditioning, M. M. Lawler, stated that while air conditioning equipment manufacturers are working to develop practical, low-cost water conservation devices for residential units in existing developed areas, a scheme has been devised that may fit the particular situations faced by architects and builders of large residential developments in some localities. This scheme involves the use of a spray pond, centrally located in a recreational park area and made attractive with suitable architectural or landscaping treatment. The water could be treated to inhibit corrosion and the system could be drained during the winter. During the hottest weather, it is estimated that only one tenth of the water normally required for air conditioners utilizing water-cooled condensers would have to be purchased from the local water departments. This is about as much as each residence uses for sanitary purposes.

In offering this plan, Lawler explained that in an average new housing development located several miles from the city supplying the water, the average family of four can be expected to use 3,000 to 4,000 cubic feet of water in a quarter, exclusive of air conditioning. When the family uses a three-ton air conditioner operated with a water cooled condenser consuming 1½ gallons per minute of cooling water per ton, in the July-September quarter they will require an additional 35,000 to 45,000 cubic feet of water. The water supply facilities would, therefore, have to be ten to twelve times as large if all the homes are air conditioned. This great capacity would be required only during the hottest months when drought conditioners are most critical.

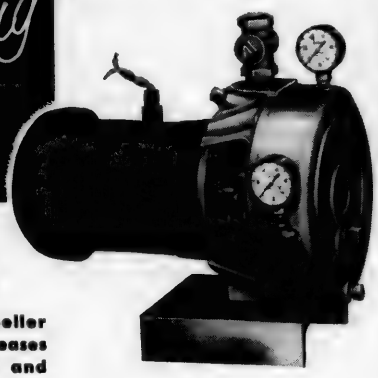
Rather than have the nearest municipality furnish all the water, the architect and the builder could design and install their own recirculating system, placing the piping under the streets along with the sanitary water supply piping.

• Texas Gas Transmission Corp., of Owensboro, Ky., filed an application January 29 with the Federal Power Commission asking approval of plans for a $1,596,000 construction program in Louisiana. The application seeks authority for constructing 24 miles of 16-inch natural gas transmission pipeline in the South Louisiana gas fields.

Especially Designed for

Air Conditioning Use!

BURKS® IHV PUMPS



with patented

"Kam-Action"®

. . . the exclusive impeller volute design which increases efficiency, performance and capacity!

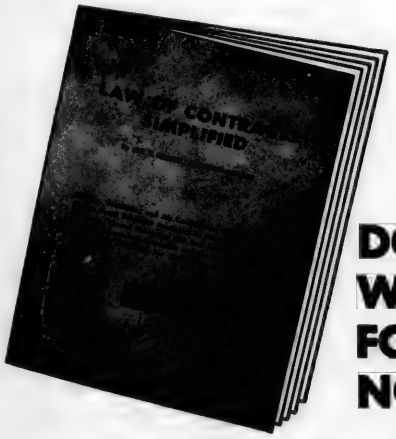
- Can be installed horizontally or vertically—without mechanical changes.
- Full length stainless steel shaft assures perfect alignment of motor, shaft and impeller.
- Balanced bronze impeller for smoother, quieter operation.
- There's an IHV Pump for your exact need—¼ hp through 5 hp—heads to 190 feet—capacity up to 110 gallons per minute.
- Equipped with supply and discharge pressure gauges, and control valve for adjusting to the most efficient pressure for each individual installation.

BURKS PUMPS

Write today for full details.

DECATUR PUMP COMPANY

75 Elk Street, Decatur, Illinois



DON'T WORK FOR NOTHING!

You may find yourself working for nothing . . . if you work under a poorly drawn contract. You may lose money . . . if you accept work without understanding the terms under which it is to be done.

Written in simple, everyday language, "Contracts Simplified" shows you the pitfalls which are often the cause of costly lawsuits. Using actual court decisions, it illustrates many of the elementary principles of law which everyone should know before drawing—or accepting—a contract. For example, do you know the law covering "fine print?" Do you know the legal aspects of a "cost plus" contract? Do you know when a contract can be rescinded? These are a few of the scores of points which are covered briefly and clearly in "Contracts Simplified." Order a copy today. You'll find it worth many times its cost in the time and trouble it saves you.

26 pages $1.00 postpaid **8½" x 11" page size.**

THE INDUSTRIAL PRESS

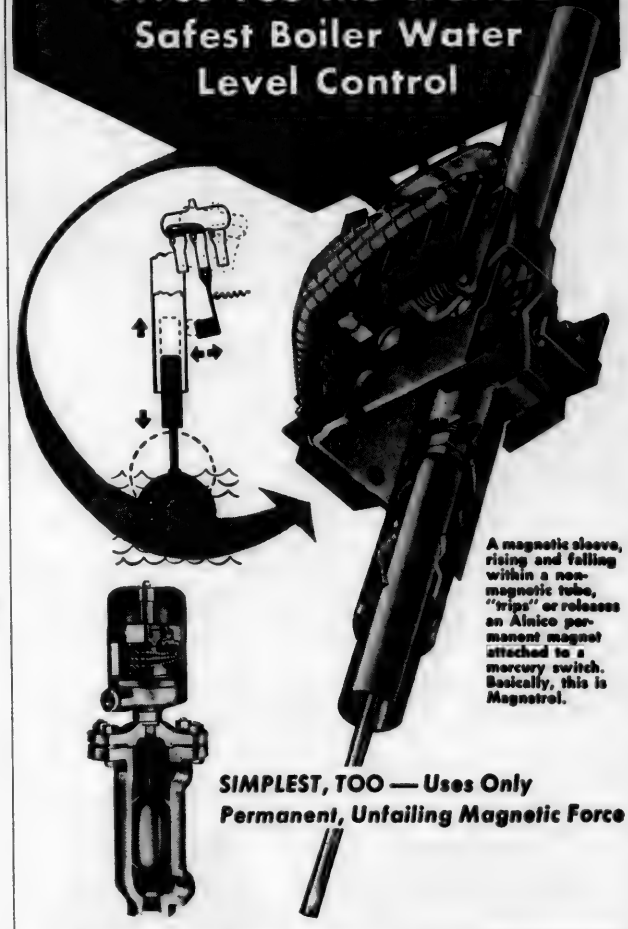
148 LAFAYETTE STREET **NEW YORK 13, N. Y.**

H&V-3-54

THIS IS WHY

MAGNETROL

Gives You the World's Safest Boiler Water Level Control



A magnetic sleeve, rising and falling within a non-magnetic tube, "trips" or releases an Alnico permanent magnet attached to a mercury switch. Basically, this is Magnetrol.

SIMPLEST, TOO — Uses Only Permanent, Unfailing Magnetic Force

In boiler water level control, there's no such thing as being "half safe". The Magnetrol principle *eliminates* the causes of eventual failure inherent in other controls.

Magnetrol has infinite operating life! "Fail-safe" and fool-proof, it almost never requires servicing, needs practically no maintenance at all. It has no bellows to stiffen or rupture . . . no packing to bind or leak . . . no diaphragms to fail . . . no electrodes to corrode or short.

Its cost? Very little more than any ordinary control! Magnetrol Units are available in single or multi-stage models for all control applications. Standard boiler units for pressures of 25 to 600 lbs. WSP.

MAGNETROL, Inc.

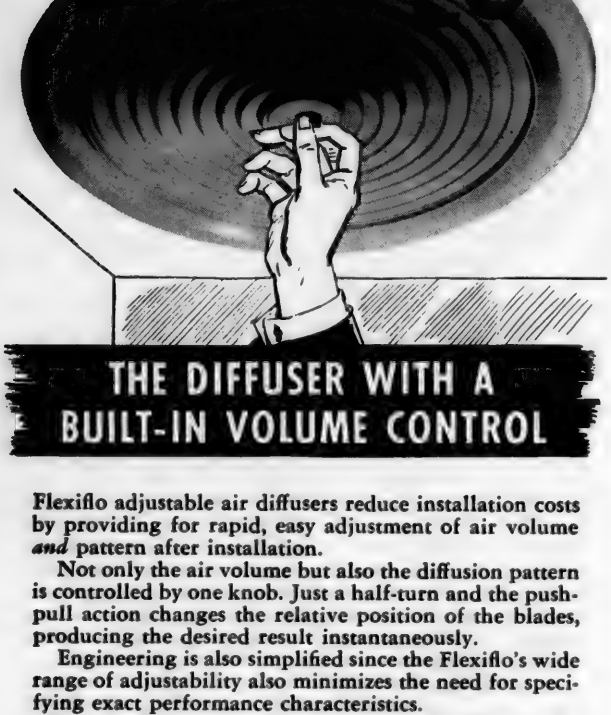
Get the Full Facts on this More Positive Boiler Water Level Control Now.

MAGNETROL, Inc. 2104 S. Marshall Blvd., Chicago 23, Ill.
Gentlemen: Please send me Catalog Section III and full information on Magnetrol Boiler Water Level Controls.

NAME_____

COMPANY NAME_____

ADDRESS_____



THE DIFFUSER WITH A BUILT-IN VOLUME CONTROL

Flexiflo adjustable air diffusers reduce installation costs by providing for rapid, easy adjustment of air volume *and* pattern after installation.

Not only the air volume but also the diffusion pattern is controlled by one knob. Just a half-turn and the push-pull action changes the relative position of the blades, producing the desired result instantaneously.

Engineering is also simplified since the Flexiflo's wide range of adjustability also minimizes the need for specifying exact performance characteristics.

Flexiflo diffusers assure uniform air distribution by using built-in equalizing deflectors which are also easily adjustable after installation. The result is a combination of draftless diffusion with efficient, trouble-free operation.

A complete line of Flexiflo diffusers for every cooling, ventilating and heating need is made in 12 standard sizes, up to a capacity of 12,000 CFM.

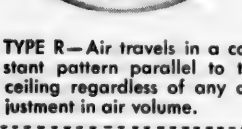
FOR COOLING

TYPE R—Air travels in a constant pattern parallel to the ceiling regardless of any adjustment in air volume.

FOR COOLING & HEATING

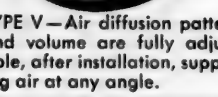
TYPE V—Air diffusion pattern and volume are fully adjustable, after installation, supplying air at any angle.

FOR SUPPLY & RETURN



TYPE CN—A combination supply and return outlet made with either the type R or V blades. Fully adjustable.

FOR SIDEWALL & CEILING



TYPE S—Provided with type R or V blades to blow air in desired pattern for ceiling or wall installation.

Write for technical data catalog on Flexiflo line

FLEXIFLO Universal Diffuser Corp.
1350 Garrison Ave. • New York 59, N. Y.

INSTITUTIONAL BUILDING

planned for several states shows increase over past schedules. Bond issues proposed.

Sharply increased expenditures for new and expanded state institutions, state office buildings and other publicly-owned and aided structures, accompanied by greater resort to borrowing for such purposes, is indicated by current reports from state capitals throughout the nation.

• **NEW YORK.**— A measure introduced in the New York legislature to carry out a recommendation by Governor Dewey calls for submission to the electorate in November of a $350 million bond issue for new mental hospital construction.

In advocating the proposed New York program, Governor Dewey, in his annual message to the state legislature, declared: In the past 11 years more than $200 million has been appropriated from current revenue for construction of mental hospitals. In the same period operating expenses more than trebled, rising from $41 to $130 million. Eleven years ago there were 90,000 patients in our mental hospitals. Today there are 112,000.

• **MASS.**— In his message to the Massachusetts legislature, Governor Herter called for authorization for the issuance of $25 million in bonds to finance state mental hospital and public health building construction. In another Massachusetts development, state lawmakers are awaiting a report from a special commission which has been conducting a study of proposals for the establishment of a new state office building in Boston.

• **COLORADO.**— Governor Thornton urged Colorado solons to authorize the issuance of anticipation warrants to finance the construction of homes for the senile and ailing. A subsequently introduced Colorado bill would authorize the state to borrow up to $1 million through anticipation warrants and pledge repayment out of money paid by the inmates for their care.

• **ILLINOIS.**— In other developments of state institutional construction and financing interest, Illinois is proceeding with its plans for construction of a new $8,963,000 state office building in Springfield. Demolition of structures on the building site was scheduled to start in January and be completed within 90 days, to clear the way for start of construction of the new building.

• **INDIANA.**— Indiana lawmakers decided against a proposal to ask Governor Craig to call a special state legislative session to approve spending $15 million from the state's $82 million surplus to build a new state office building in Indianapolis. The office building issue was deferred until exact data on the site, size and cost of the proposed structure could be presented.

• **MICHIGAN.**— A $29 million state institutional building program was recommended to the Michigan legislature by Governor Williams. He proposed an appropriation of $14.5 million from the general fund, and $14.3 million from hospital bond issue money for construction at mental institutions. Last year the governor had asked expenditure of $12.5 million from the general fund for state building and the legislature appropriated $9.2 million.

• **PENN.**— John N. Forker, retired vice president of Koppers Co., Pittsburgh, was named late last year to succeed the late Oscar N. Lindahl as executive director

of the Pennsylvania General Authority, which is proceeding with its multi-million dollar building program. Forker also serves, under the appointment, as executive director of the Pennsylvania State Highway and Bridge million revenue bond financed construction program Authority. In the two posts he is administering a $410 started during the Duff Administration and expanded by Governor Fine and the Pennsylvania legislature in 1951 and again last year.

A. H. BARKER PASSES

A. H. Barker, British pioneer in low temperature radiant heating, died recently in London at the age of 84. In earlier years he paid several visits to the United States lecturing on technical subjects. Mr. Barker has been credited with designing the first installation of low temperature panel warming in the world, which was installed in the Royal Liver Building in Liverpool before World War I. He obtained both arts and science degrees at the University of London, mostly by spare time study and was awarded Witworth Scholarships in two successive years for taking first place, an achievement not paralleled to this day. A versatile scholar, he wrote a textbook on graphical solutions to problems in the calculus and was an accomplished English literature student.

Mr. Barker spent several of his early years in industry and engineering and in 1911 started in practice as a consulting mechanical engineer in heating and ventilating. He published a textbook, Barker on Heating, which is said to contain the first systematic study of the engineering principles of central heating. He was a past president of the Institute of Heating and Ventilating Engineers.

LONDON LETTER

(*Concluded from page* 98)

The front section has a door for the firing apparatus, the two sides each have inspection doors, and the back panel has a number of convection tubes attached to it which bow out into the combustion space.

This nest of tubes provides the convection heating surface so obviously missing from the old type of sectional boiler. The exit for the gases is at the bottom of the back section, but in order to get there they have to flow up past the baffle created by the nest of convection tubes, and then down between the tubes themselves. A low refractory brick wall divides the flue from the furnace chamber so that the gases cannot short-circuit the convection section by going underneath it. Above the large box which forms the heating surface there is a boiler drum, 7 ft long and 2 ft in diameter, containing steam baffles and connected to the water walls in such a way as to promote good circulation. The incoming feed-water is sprayed into the drum above the water level. Efficiencies of above 80% have been obtained with this boiler when burning bituminous coal on an underfeed stoker at the Ministry of Supply Telecommunications Research Establishment. The boiler is of French parentage but seems to be doing nicely in Britain [Industrial Heating Engineer, **15**, *98*, 363 (90 High Holburn, London, W.C. 7)].

Experience has taught the Universal Diffuser Corporation that the Alnor Velometer minimizes time required to balance an installation of Flexiflo diffusers. They *recommend* the Alnor Velometer because they know it consistently measures *actual* air flow precisely and quickly.

The Velometer is the *only* instantaneous, direct reading air velocity meter—accurate in all ranges, from high to low—compact, portable, easy to understand and use. Wide assortment of jets and fittings makes this precision instrument ideally suited for all air velocity measurement.

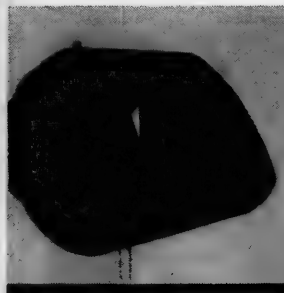
Get an Alnor Velometer for your air measurement needs. You'll save time and money wasted in balancing air distribution on your *next* installation. If you'd like a copy of Universal's instructions on balancing Flexiflo Diffusers with the Velometer, just send the coupon below.

Alnor **ILLINOIS TESTING LABORATORIES, INC.**
Precision Instruments for Every Industry

PYROMETERS • VELOMETERS • DEW POINTERS • PYROCONS
PYRO LANCES • THERMO-ANEMOMETERS • CONTROLLERS

Illinois Testing Laboratories, Inc.
Room 514, 420 N. LaSalle St.
Chicago 10, Illinois
☐ Send Flexiflo Installation Manual
☐ Send Velometer Bulletin 2448

Name.....
Company.....
Address.....
City.....Zone.....State.....



DOWN-DRAFT VIEW

Gate opens outward to relieve down drafts which might affect flame. An optional safety switch closes main gas valve in case of prolonged down draft, thus providing full protection.

UP-DRAFT VIEW

Gate opens inward to regulate updrafts in conventional, proven manner, checking any excess in draft.

field

"MG" Draft Controls

ENGINEERED SPECIFICALLY FOR

GAS

fired industrial and commercial plants

1. Double acting gate opens inward to regulate up-drafts and outward to relieve down-drafts.
2. Adding or taking off weights provides simple adjustment for up-draft conditions at time of installation.
3. Control will relieve internal or down-draft pressures of only a few thousandths of an inch.
4. Weights attached to gate itself are factory set to insure extreme sensitivity to down-draft conditions.
5. Corrosion resistant knife edge bearings resting on self-aligning bearing plates assure extreme sensitivity yet long life.
6. Side wings improve the regulation, making the control accurate at all gate positions.
7. Long collar keeps gate out of the path of flue gases — resulting in greatly increased life.

The Field "MG" has met the most rigid municipal requirements for commercial and industrial installations. It is being used with full approval of the nation's leading gas companies in the nation's largest cities. Fully safe, fully proven, it provides for gas-fired installations the same accurate, dependable performance, the fuel economy so long provided by Field Draft Controls for oil and coal fired furnaces. Write for complete information.

FIELD CONTROL DIVISION

of H. D. Conkey & Company — Mendota, Illinois

AFFILIATES: Conco Building Products, Inc. — Brick, Tile, Stone
Conco Materials Handling Division — Cranes, Hoists

COMING EVENTS

Where listed, names or titles of individuals are those from whom further information is available.

CORROSION ENGINEERS CONFERENCE—Tenth annual conference and exhibition of the National Association of Corrosion Engineers, in Kansas City, Mo. A. B. Campbell, Executive Secretary of the Association, 1061 M & M Building, Houston 2, Texas. . . . . **MARCH 15-19, 1954.**

INDUSTRIAL HEALTH CONFERENCE—Annual meeting of five groups, including the American Industrial Hygiene Association, at the Hotel Sherman, Chicago, Ill. Publicity Committee, 205 N. LaSalle St., Chicago 1, Ill. . . . **APRIL 26-30, 1954**

AIR POLLUTION MEETING—Annual meeting of the Air Pollution Control Association, at the Patten Hotel, Chattanooga, Tenn. Robert T. Griebling, executive secretary of the Association 4400 Fifth Ave., Pittsburgh 13, Pa. . . . **MAY 3-5, 1954**

WELDING SOCIETY MEETING—1954 National spring technical meeting of the American Welding Society, at the Hotel Statler, Buffalo, N. Y. J. G. McGrath, national secretary of the Society, 33 W. 39th St., New York 18, N. Y. . . . . **MAY 4-7, 1954.**

WELDING SOCIETY EXPOSITION—1954 Welding and Allied Industry Exposition of the American Welding Society, at the Buffalo Memorial Auditorium, Buffalo, N. Y. J. G. McGrath, national secretary of the Society, 33 W. 39th St., New York 18, N. Y. . . . . **MAY 5-8, 1954.**

INDOOR COMFORT EXPOSITION—The National Indoor Comfort Exposition, at the Commercial Museum, Philadelphia, Pa., in conjunction with the 32nd Convention of the Oil-Heat Institute of America, Inc. R. H. L. Becker, secretary of the Institute, 500 Fifth Ave., New York 36, N. Y. . . . . **MAY 16-20, 1954.**

GAS APPLIANCE MEETING—Annual meeting of the Gas Appliance Manufacturers Association, at The Drake Hotel, Chicago, Ill. H. Leigh Whitelaw, managing director of the Association, 60 E. 42nd St., New York, N. Y. . . . . **MAY 19-21, 1954.**

STEEL BOILER MEETING—Annual meeting of the Steel Boiler Institute, at The Traymore Hotel, Atlantic City, N. J. Secretary of the Institute, Land Title Building, Philadelphia 10, Pa. . . . . **MAY 24-25, 1954.**

HEATING AND PIPING CONTRACTORS CONVENTION—65th annual convention of the Heating, Piping and Air Conditioning Contractors National Association, at the Hotel Traymore, Atlantic City, N. J. Lloyd B. Gruman, Jr., acting secretary of the Association, 1250 Avenue of the Americas, New York 20, N. Y. . . . . **MAY 24-28, 1954.**

NDHA CONVENTION—Annual convention of the National District Heating Association, at The Greenbrier, White Sulphur Springs, West Va. John F. Collins, Jr., secretary of the Association, 827 N. West Euclid Ave., Pittsburgh 6, Pa. . . . . **MAY 25-28, 1954.**

IBR MEETING—Meeting of the Institute of Boiler & Radiator Manufacturers, at Seaview Country Club, Absecon, N. J. Secretary of the Institute, 60 E. 42nd St., New York, N. Y. . . . . **JUNE 2-4, 1954.**

PLANT MAINTENANCE SHOW—Western Plant Maintenance Show at the Pan Pacific Auditorium, Los Angeles, Calif. Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y. . . . . **JULY, 13-15, 1954**

INTERNATIONAL INSTRUMENT CONGRESS—First International Instrument Congress and Exposition, sponsored by The Instrument Society of America, to be held in the Commercial Museum and Convention Hall, Philadelphia, Pa. Richard Rimbach, managing director of the Exposition, 921 Ridge Ave., Pittsburgh 12, Pa. . . . . **SEPTEMBER 13-25, 1954.**

POWER SHOW—21st National Exposition of Power and Mechanical Engineering, at the Comercial Museum, Philadelphia, Pa., to be held under the auspices of The American Society of Mechanical Engineers. Charles F. Roth, manager of the Exposition, 480 Lexington Ave., New York 17, N. Y. . . . . **DECEMBER 2-7, 1954.**

HEATING & VENTILATING EXPOSITION—12th International Heating & Ventilating Exposition, at the Commercial Museum and Convention Hall, Philadelphia, Pa., held under the auspices of the American Society of Heating and Ventilating Engineers. Charles F. Roth, manager of the Exposition, 480 Lexington Ave., New York 17, N. Y. . . . . **JANUARY 24-28, 1955.**

HEATING AND VENTILATING'S

Ad-Digest SERVICE

Below and on the following pages are given brief digests of the advertisements appearing in this month's issue. Use this Digest to locate and refer to the advertisements in which you are particularly interested, then fill out and mail the prepaid postcard to request further information from manufacturers.

NOTE: While every attempt is made to list all advertisements, those which are received after the published closing date may not appear. The Index of Advertisers lists all the advertisements in this issue.

PUMPS. Page 145. A line of air conditioning pumps which saves in engineering time as well as installation time and with no extra parts to buy. Line includes a packaged pump for air conditioning and refrigeration, a close coupled pump, and a vertically-mounted pump.....Item 201

HEAT TRANSFER SURFACE. Page 23. Industrial type finned tubing in a full line and available to meet all specifications. A 4¼ x 4¼ inch fin has just been added to the line. Illustrated bulletin available.
.....Item 202

COOLING TOWERS. Page 31. A line of cooling towers with Koppers pressure creosoting used on all wood employed in the construction of the towers. This preservative protects the tower against fungus and marine parasites and preserves the timber. Towers made in sizes from 2 through 100 tons. Catalogs available.
.....Item 203

FIRE PROTECTION EQUIPMENT. Page 171. A proved reliable, economical line of interior fire protection equipment. Line includes 490 cabinets alone.....Item 204

PIPING. Page 155. A special fabricating service to save time, material and labor in piping systems. Numerous flanged joints are eliminated and several fittings combined into one. All types of materials can be so fabricated in sizes from 3 to 44 inches in diameter. Bulletin available.
.....Item 205

PACKAGED AIR CONDITIONER. Page 153. A dual circuit central station packaged air conditioner combining two separate refrigeration circuits, two compressors, two motors, cooling section and evaporative condenser in one central station.
.....Item 206

AIR DIFFUSERS. Pages 168-169. Square and rectangular diffusers custom-designed with built-in diffusing vanes in a wide variety of louver patterns. For ceiling or sidewall location. Catalog available.
.....Item 207

FUEL OIL HEATERS. Page 158. If high fuel oil temperatures are what you need, this indirect gas fired fuel oil heater is the answer. It gives any desired oil temperature without use of expensive electric boosters and is applicable to all types of oil-fired apparatus. Bulletin available.
.....Item 208

STEEL PIPE. Page 57. No matter how intricate the weld, it can be done readily with this pipe which has uniform ductility, uniform lengths, uniform thread, uniform weldability, uniform size, uniform strength and uniform roundness and straightness.
.....Item 209

TEMPERATURE REGULATOR. Page 72. With this temperature regulator designed to limit heater steam pressures to an adjustable maximum, the need for a separate reducing valve is completely eliminated. It takes steam directly from the boiler, reduces the pressure and regulates the flow as required to maintain a constant temperature output from the heater. Bulletin available.....Item 210

ROTARY VENTILATORS. Page 159. Where the problem is ventilation, the solution is a rotary ventilator with or without fans. A two-mile per hour wind operates the unit and it continues to exhaust during wind lulls due to balanced design. Catalog available.....Item 211

TANK DRAIN. Page 44. A tank drain for hot water expansion tanks not so equipped. This drain makes the draining of waterlogged expansion tanks simple, quick and positive. Information available.
.....Item 212

FAN BASES. Page 187. Custom-built vibration isolating fan bases which thoroughly isolate the motor and fan from the supporting floor at all operating speeds. Each base is a custom-designed job. Technical bulletin available. Item 213

FREON COMPRESSOR. Page 48. Years were spent in developing this new Freon compressor of which the features include the trim, sturdy construction, easy removal of gas strainer in the suction line, operating efficiency, and high capacity. Information available.....Item 214

PIPE HANGERS. Inside front cover. This company has a stock pipe hanger for every piping requirement. Swivel pipe ring type is illustrated and described. This is available in 12 sizes up to 8 inches.
.....Item 215

MIXING VALVES. Page 170. A shower mixing valve, concealed, with all sliding parts of stainless steel. Features include non-ferrous bellows type thermostat and integral shut off.....Item 216

AIR CONDITIONING UNITS. Page 40. Air conditioning units with five outstanding features, including muggy air control, blow-through design, anti-sweat construction, quiet operation and graceful lines. Bulletin available.....Item 217

HEATING COILS. Page 161. Steam distributing tube heating coils for jobs where regulated steam control is needed. Uniform steam distribution is provided through entire coil even when low throttled.....Item 218

Circle numbers corresponding to the advertisements in which you are interested, print your name and address clearly. Information will be sent directly from manufacturers.

PLEASE SEND US MORE INFORMATION.

Circle below item numbers on which you wish further information.

201	202	203	204	205	206	207	208	209	210	211	212	213	21
215	216	217	218	219	220	221	222	223	224	225	226	227	22
229	230	231	232	233	234	235	236	237	238	239	240	241	24
243	244	245	246	247	248	249	250	251	252	253	254	255	25
257	258	259	260	261	262	263	264	265	266	267	268	269	27
271	272	273	274	275	276	277	278	279	280	281	282	283	28
285	286	287	288	289	290	291	292	293	294	295	296	296	29
299	300	301	302	303	304	305	306	307					

PLEASE PRINT Mar. H-5

This service available only to U. S. and Canadian readers

Name .....**Title**.....

Firm .....

Nature of Firm's Business .....

Street .....

City ..... **Zone**..... **State**.....

This card is void after [illegible] 1954

Ad-Digest SERVICE

PIPE INSULATION. Pages 28-29. An unusual pipe insulation which installs itself in that it is poured on underground pipe, tamped and backfilled, and the job is insulated. The heat in the pipe fuses the insulation to the pipe resulting in an underground pipe insulation at low cost. Availible in three grades. Literature available.....Item 219

PUMPS. Page 161. Unit pumps for air conditioning. All brass intermediate shaft design prevents corrosion, eliminates costly repairs. Available in ¼ to 5 hp sizes. Catalog available.....Item 220

MOTORS. Page 149. A company with 63 years of motor manufacturing experience and with standard motors from 1/20 to 5 hp or hermetic motors from ⅛ to 20 hp. Catalogs available.....Item 221

AIR CONDITIONING. Page 62. A system of individually controlled units for multi-room buildings and which heat in winter and cool in summer. Same simple piping circuits supplies chilled water in summer and hot water in winter and no duct work is needed. Information available. Item 222

FANS AND BLOWERS. Page 32. A line of certified rating blowers with typical installations in hospitals, schools, institutions and laboratories which attest to the wide acceptance of the line.....Item 223

FUME DUCTS. Page 173. If you scratch or damage the surface of many corrosion-proof fume ducts you expose a non-resistance structural material and corrosion gets started. This is not true of this unplasticized, rigid polyvinyl chloride which is corrosion-proof, and a self-supporting structural material in itself. Available in standard stock duct sizes in both round and square sections.....Item 224

DUCT LINER. Page 11. An air conditioned store decided that the cost of duct lining was unnecessary. When the store was opened the noise level was too high and it was necessary to do the job over. The noise problem was solved with this duct liner which is made of glass fiber. Many contractors use this on every job, even those where duct liner is not specified. Information available.....Item 225

WELDING FITTINGS. Page 43. The distributor of this line of welding fittings assumes the responsibility of dealing with many manufacturers' salesmen and expediting and following through your orders. Save purchasing man hours by using this line.....Item 226

POWER ROOF VENTILATORS. Page 55. A line of power roof ventilators of all aluminum, low silhouette, competitively priced, and in a large range of sizes with capacities from 100 to 17,000 cfm. Information available.....Item 227

REGISTERS. Page 58. Two lines of registers equipped with opposed blade damper —one for supply air, the other for return air. These dampers insure uniform distribution of air over the entire face of the register and provide positive damper setting in any position from fully opened to fully closed. Catalog available. Item 228

CONVECTORS. Page 33. Convector radiators which offer the best in long life and economical service. Have a damper which conceals the curved outlet air grille; air vent can be located at either end of outlet grille; steam carrying passages are copper or copper alloy; front panel is quickly removed; lower grille snaps in, and enclosure is Bonderized. Bulletin available.....Item 229

WELDING FITTINGS. Pages 34-35. This company's new 304-page fittings catalog is now available. It contains 209 pages of specifications and ordering information and 56 pages of technical data with latest code provisions. It is easy to use, fully tabbed with each section having its own pictorial index and table of contents.
.....Item 230

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OIL UNIT HEATERS. Page 54. A line of suspended oil-fired unit heaters fired with a gun-type burner and with an output of 220,000 Btu per hour. Company also makes a line of suspended horizontal furnaces for small or large heating jobs. Information available.....Item 232

COPPER TUBE. Page 135. According to a large contractor in Missouri the many desirable characteristics of this line of copper water tube make it the ideal material for radiant panel heating and prefabrication is easier and time and labor are saved. Advantages include easy to bend, handy lengths, solder or compression fittings can be used, and non-rusting characteristics.....Item 233

UNIT HEATERS. Page 30. A revolving unit heater in which the moving air stream touches the worker for only a few seconds at a time and gives a live sensation of comfortable well being. In summertime heater can be used for circulating air. Bulletin available.....Item 234

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MOTORS. Pages 26-27. Motors of three types, open-drip-proof, totally enclosed fan-cooled, and explosion proof in the NEMA rerate sizes which will give better performance and lower maintenance costs in general-purpose applications. Technical bulletins available.....Item 239

AIR FILTER. Page 38. A new automatic air filter that keeps itself cleaner with pulse-type action. While each panel in the revolving curtain is submerged in the cleaning tank it is agitated vigorously by a compressed air drive. Has no electrical connections in the air stream, can be operated by remote control, has a variety of media designs available, and no rigid mechanical drive connections are needed. Information available.....Item 240

ELECTRIC PRECIPITATOR. Page 46. How an electric precipitator was used in a biscuit company where hot cocoanut oil was sprayed on crackers and which presented an unwelcome oil mist problem. A fan exhaust system wasted gallons of cocoanut oil and created a fire trap. A precipitator solved the problem. Information available.....Item 241

AIR CONDITIONING. Page 42. A Miami hotel, 100% air conditioned, has a 120-ton system with a water chiller, Freon condenser, liquid receiver and oil separator made by this manufacturer who makes a complete line of air conditioning equipment. Information available.....Item 242

ZONE HEATING. Page 65. Every room in a building is an individual zone with its own thermostat with this system, which consists of an individual unit with a fan driven by a small steam turbine which operates from the steam in the heating system. On and off cycling and "cold 70° stratification is eliminated and the individual room temperature control gives comfort and economy in every type and size of residential, institutional and commercial building. Literature available.
.....Item 243

AIR CONDITIONING. Page 58. The Ford dream shop where the company's engineering staff's advanced styling section operates is just one of the many styling areas which depend on clean, conditioned air supplied by this company's air handling and air conditioning equipment. The expert know-how of the company's engineers is on tap for industry at all times.
.....Item 244

AUTOMATIC FILTERS. Page 68. Where automatic filters are used, this company's self-cleaning type automatic filter is specified by a large retail chain. These filters adapt themselves to all types of air conditioning systems, are self-cleaning and easily supervised by laymen. Folder available.....Item 245

MOTORS. Page 37. The red power spot on refrigeration or air conditioning equipment means that it is powered by this company's dependable motor. A booklet entitled "Motor Showdown," a candid report on comparative studies of motor performance tests conducted in accordance with A.I.E.E. standards, is available.
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VALVES. Page 81. For lower cost control of moderately corrosive fluids, this company's nickel iron valves with type 316 stainless steel trim provide corrosion resistance well above the moderate need in many processing services with an investment well below that for all stainless steel valves. Every part in contact with the fluid is the right metal to block corrosion and beat wear. Information available. Item 249

ELECTRIC CONTROLS. Page 20. These controls provide individual room temperature control for guests at a large motel in Grand Rapids. The simplest possible type of control was installed in this example of present-day motel design and the individual control of heat in each room allows the guests to select the temperature

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they like best. The owner is considering a central time clock for reducing heat supply during sleeping hours. These controls solve a wide range of heating, cooling and ventilating problems. Information available.....Item 250

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AIR CONDITIONERS. Page 73. Individual room air conditioners are installed in the Barbizon Tower, one of Atlanta's finest apartment houses. These units are of two types. The floor type for free standing mounting beneath a window or along a wall, and a ceiling type for suspended mounting. Both types are for use with central systems circulating chilled or hot water or Freon. Also available in basic and hide-away types for fully concealed installations. Bulletin available....Item 261

GAS UNIT HEATERS. Page 2. These heaters are made in 7 sizes ranging from 25,000 to 200,000 Btu per hour heat input and provide fully automatic, direct-fired heating for large or small areas. This is the newest addition to the company's line which includes baseboard heating, convectors for non-residential use as well as homes, hot water heating controls, radiator valves and other specialities.....Item 262

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GAS UNIT HEATERS. Page 22. Gas unit heaters available in sizes from 25,000 to 200,000 Btu per hour input. They give you new freedom and flexibility in laying out a heating system and can be installed just about anywhere you can run a gas pipe. Catalog available.....Item 275

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STEAM TRAPS. Page 141. A technical explanation of why this company's trap operates on the least temperature difference between steam and condensate and why it opens its valve wider and has a larger capacity than other traps. Catalog available. .....Item 284

REFRIGERATION. Page 75. The William Penn Hotel in Pittsburgh is served in five ways by this company's refrigeration equipment. These include air conditioning, cooling drinking water, refrigeration of foods, freezer service and making ice. This hotel has used the maker's equipment since 1936 and finds it efficient and dependable. .....Item 285

FLEXIBLE DUCT. Page 153. This spiral wire re-inforced ducting is available in sizes from 3 to 36 inches inside diameter, has low first cost, easy to connect and install, and can be cut to any length on the job. Made with either nylon base or cotton base. Details available. ...Item 286

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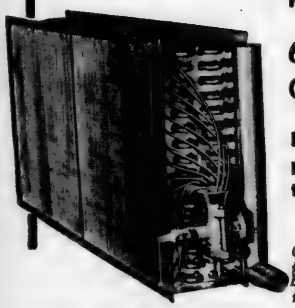

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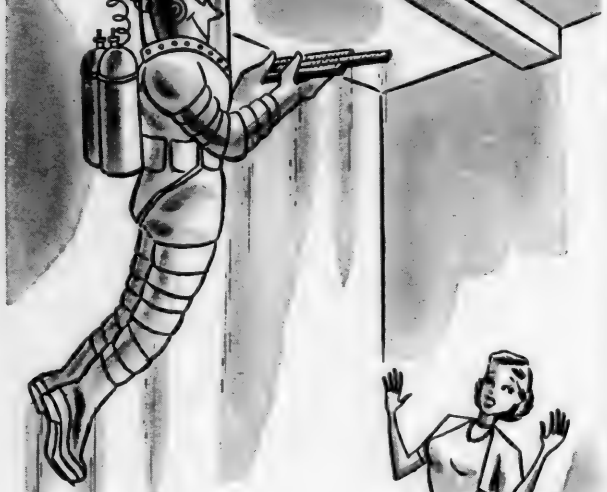

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HEATING AND VENTILATING'S 26th Year of Publication of Monthly Degree-Day Data

City	January		
	1954	1953	Normal
Abilene, Texas (A)	581	403	673
Albany, New York (A)	1436	1101	1318
Albuquerque, New Mexico (A)	818	700	970
Alpena, Michigan (C)	1414	1219	1358
Anaconda, Montana (C)	1255	1151	1321*
Asheville, North Carolina (C)	743	700	794
Atlanta, Georgia (C)	609	546	632
Atlantic City, New Jersey (C)	924	753	905
Augusta, Georgia (A)	511	457	521
Baltimore, Maryland (C)	875	714	880
Billings, Montana (A)	1469	886	1305
Binghamton, New York (C)	1272	971	1218
Birmingham, Alabama (A)	576	478	623
Bismarck, North Dakota (A)	1996	1519	1730
Block Island, Rhode Island (A)	1048	876	1026
Boise, Idaho (A)	876	737	1169
Boston, Massachusetts (A)	1201	930	1113
Bozeman, Montana (C)	1366	967	1403
Buffalo, New York (A)	1282	1038	1225*
Burlington, Iowa (A)	1246	1162	1271
Burlington, Vermont (A)	1612	1241	1460
Butte, Montana (C)	1309	997	1309*
Cairo Illinois (C)	865	735	856
Charleston, South Carolina (C)	373	350	445
Charlotte, North Carolina (C)	667	560	704
Chattanooga, Tennessee (A)	706	587	725
Cheyenne, Wyoming (A)	1007	907	1225
Chicago, Illinois (C)	1122	1061	1190*
Cincinnati, Ohio (C)	885	812	942
Cleveland, Ohio (A)	1124	969	1132
Columbia, Missouri (A)	1070	943	1091
Columbia, South Carolina (C)	497	416	538
Columbus, Ohio (C)	943	919	1051
Concord, New Hampshire (A)	1432	1153	1392
Concordia, Kansas (C)	1190	1017	1144
Dallas, Texas (A)	576	429	607
Dayton, Ohio (A)	1035	961	1094
Deer Lodge, Montana (C)	1237	941	1376*
Denver, Colorado (C)	884	781	1125
Des Moines, Iowa (A)	1405	1260	1330
Detroit, Michigan (A)	1220	1062	1203
Devils Lake, North Dakota (C)	2157	1721	1866
Dodge City, Kansas (A)	1036	797	1076
Dubuque, Iowa (C)	1430	1311	1414
Duluth, Minnesota (C)	1835	1622	1448
Eastport, Maine (A)	(a)	1124	1333
Elkins, West Virginia (A)	1029	884	1017
El Paso, Texas (A)	551	450	670
Ely, Nevada (A)	1166	973	1302
Erie, Pennsylvania (C)	(a)	922	1128
Escanaba, Michigan (C)	1490	1303	1473
Evansville, Indiana (A)	945	837	939
Fargo, North Dakota (A)	2060	1690	1795
Fort Smith, Arkansas (A)	794	677	775
Fort Wayne, Indiana (A)	1126	1073	1200
Fort Worth, Texas (A)	592	404	622
Fresno, California (A)	560	441	629
Galveston, Texas (C)	243	210	356
Grand Junction, Colorado (A)	994	970	1271
Grand Rapids, Michigan (A)	1279	1157	1287
Green Bay, Wisconsin (C)	1521	1369	1516
Greensboro, North Carolina (A)	797	653	806
Greenville, South Carolina (A)	642	569	673
Harrisburg, Pennsylvania (A)	1094	889	1051
Hartford, Connecticut (A)	1251	1009	1178
Hatteras, North Carolina (C)	357	419	527
Havre, Montana (C)	1915	1273	1513
Helena, Montana (A)	1458	937	1469
Houston, Texas (C)	253	233	378
Huron, South Dakota (A)	1773	1430	1597
Indianapolis, Indiana (A)	1052	989	1122
Jackson, Mississippi (A)	479	384	405
Kansas City, Missouri (A)	1101	937	1085
Knoxville, Tennessee (A)	774	622	760
La Crosse, Wisconsin (A)	1526	1384	1528
Lander, Wyoming (A)	1168	1021	1494
Lansing, Michigan (A)	1291	1179	1277
Lewiston, Maine (O)	1421	1137	1452*
Lincoln, Nebraska (C)	1325	1199	1240
Little Rock, Arkansas (A)	712	555	719

City	January		
	1954	1953	Normal
Livingston, Montana (C)	1358	865	1220*
Los Angeles, California (C)	292	157	328
Louisville, Kentucky (A)	890	764	933
Lynchburg, Virginia (A)	857	727	846
Macon, Georgia (A)	453	435	497
Madison, Wisconsin (C)	1408	1280	1417
Marquette, Michigan (C)	1472	1318	1435
Memphis, Tennessee (A)	684	588	725
Meridian, Mississippi (A)	506	415	561
Milwaukee, Wisconsin (A)	1296	1216	1336
Minneapolis, Minnesota (A)	1693	1488	1562
Moline, Illinois	1284	974	1296
Montgomery, Alabama (A)	466	427	517
Nantucket, Massachusetts (A)	1021	878	1020
Nashville, Tennessee (A)	765	609	778
New Haven, Connecticut (A)	1191	952	1113
New Orleans, Louisiana (C)	264	209	341
New York, New York (C)	1006	832	995
Newark, New Jersey	1088	876	1039
Norfolk, Virginia (C)	713	535	729
North Head, Washington (C)	(a)	551	704
North Platte, Nebraska (A)	1248	999	1271
Oak Ridge, Tennessee (C)	795	650	(a)
Oakland, California (C)	507	376	552
Oklahoma City, Oklahoma (C)	843	672	843
Omaha, Nebraska (A)	1399	1243	1302
Parkersburg, West Virginia (C)	919	778	949
Peoria, Illinois (A)	1159	1125	1240
Philadelphia, Pennsylvania (C)	971	799	933
Phoenix, Arizona (C)	388	259	425
Pittsburgh, Pennsylvania (C)	985	806	992
Pocatello, Idaho (A)	1420	1145	1358
Portland, Maine (A)	1069	885	1333
Portland, Oregon (C)	1454	1124	1373
Providence, Rhode Island (A)	758	505	791
Pueblo, Colorado (A)	1206	901	1125
Raleigh, North Carolina (C)	872	780	1104
Rapid City, South Dakota (A)	685	521	691
Reading, Pennsylvania (C)	1387	1038	1361
Red Bluff, California (A)	1057	857	1017
Reno, Nevada (A)	594	447	617
Richmond, Virginia (C)	916	755	1048
Rochester, New York (A)	829	654	828
Roswell, New Mexico (A)	1310	1058	1249
Sacramento, California (C)	696	538	787
St. Joseph, Missouri (A)	529	404	614
St. Louis, Missouri (C)	1219	1048	1017
Salt Lake City, Utah (A)	957	890	983
San Antonio, Texas (A)	951	784	1194
San Diego, California (A)	324	278	462
Sandusky, Ohio (C)	302	156	317
San Francisco, California (C)	1094	972	1122
Sault Ste. Marie, Michigan (A)	412	324	462
Savannah, Georgia (A)	1665	1424	1587
Scranton, Pennsylvania (C)	370	355	424
Seattle, Washington (C)	1212	972	1141
Sheridan, Wyoming (A)	796	545	753
Shreveport, Louisiana (A)	1425	962	1392
Sioux City, Iowa (A)	479	416	550
Spokane, Washington (A)	1515	1413	1423
Springfield, Illinois (C)	1175	832	1243
Springfield, Missouri (A)	1085	993	1116
Syracuse, New York (A)	963	841	1001
Tacoma, Washington (C)	1374	1064	1225
Terre Haute, Indiana (A)	(a)	566	797
Toledo, Ohio (A)	1044	959	1107
Topeka, Kansas (C)	1173	1031	1197
Trenton, New Jersey (C)	1150	954	1088
Tulsa, Oklahoma	1052	848	1004
Utica, New York (O)	864	732	856
Valentine, Nebraska (C)	1464	1125	1248*
Walla Walla, Washington (C)	1309	1128	1361
Washington, D. C. (C)	930	508	1023
Wichita, Kansas (A)	889	724	884
Williston, North Dakota (C)	1056	846	1023
Winnemucca, Nevada (C)	2034	1511	1705
Yakima, Washington (A)	960	780	1153
	(a)	805	1181

(a) Data not available

*Same normal figures as previously listed by HEATING AND VENTILATING since new figures are not available. All other normal figures in this table are based on a 30-year period covering 1921 to 1950, inclusive, recently compiled and published by the U. S. Weather Bureau.

Figures in this table, with seven exceptions, based on local weather bureau reports. Exceptions are Utica and Lewiston, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Corp., Utica, N. Y.; and Norman E. Ross, Bursar, Bates College, Lewiston, Me., respectively; Anaconda, Bozeman, Butte, Deer Lodge and Livingston, Mont., through the courtesy of the Montana Power Company.

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• A. B. Drastrup has been elected executive vice president of the A. M. Byers Co. Mr. Drastrup became associated with Byers in 1931, and has had broad experience in virtually all of the company's operations. Since 1946 he has been manager of steel sales. Three years ago he was also named assistant to the president. The elections of J. F. Byers, Jr., and B. M. Byers as vice presidents of the company also were announced. The former has been with the company since 1937, and has been a director since 1939. He has been assistant to the president since 1949. B. M. Byers has been general manager of wrought iron sales for the past year.

• Expansion of the company's sales staff, involving a number of major changes and promotions, has been announced by the Airtemp Division of Chrysler Corp. Four sections now will operate under the direction of J. F. Knoff, vice president in charge of sales. They are: Sales, headed by M. T. Bard; sales administration, by S. R. Prugh; merchandising, under E. A. Nash; and Airtemp Construction Corp., an Airtemp subsidiary, under R. B. Stotz. With the expansion, four new sales posts and two staff specialists also have been created.

WHAT READERS SAY

Piping for High Pressure Heating Systems

EDITOR, HEATING AND VENTILATING:

The piping details for the high pressure heating systems on page 10 in your December issue, show ¼ inch petcocks for continuous bleeding of steam as well as a check valve to break the vacuum that would occur only when the automatic control valve closed. In my opinion, this type of system would only add to the troubles of corrosion that would occur in a condensate return system. It would also not be practical to have a continuous bleed of steam from a system and would in fact only be a waste of steam.

Why would it not be more practical to merely use a float and thermostatic trap without the check valve or petcock or use an inverted bucket trap with a thermic element installed in the bucket? This is only one instance that I know of in which the air or other media passing over the heating coil were quite low in temperature. In this case, when the control valve opened, water hammer might occur in the heating coil. If this did occur, it would then only be necessary to install an automatic air vent to break the vacuum in the coil. The automatic air vent would then bleed off the air when the automatic steam valve opened, thereby eliminating the corrosion problem due to excessive oxygen.

The piping details of this system, as well as the open gravity and vacuum illustrated on the detail sheet, show two coils connected to one trap. This is in violation of the first principle of steam trapping. Coils so installed would alternately cycle hot and cold due to slight pressure difference which would occur between the coils. This would cause very irregular heat output of the system and might cause freezing if on fresh air.

(*Continued on page* 172)

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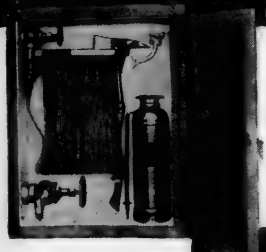

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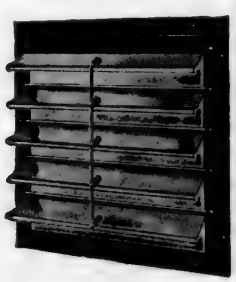

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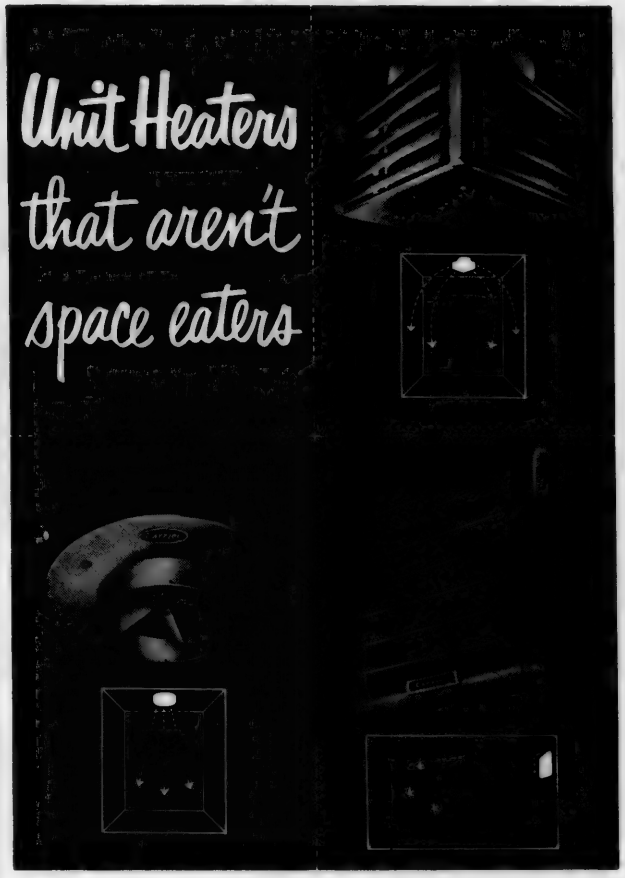

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CARRIER Four-way Directed-flo Unit Heater (top). Through independently controlled warmed air streams from four easily adjusted outlets, and from heights up to 30 feet, this unit provides quick heat *in any direction, at any angle, in any capacity* within the respective ranges of its seven sizes —82,000 to 500,000 Btu per hour.

CARRIER Projection Unit Heater (lower left). This single discharge high ceiling type unit with wide selection of outlet diffusers is available in seven sizes and a choice of coils for low or standard temperature rise. Capacities from 32,000 to 492,000 Btu per hour.

CARRIER Propeller-fan Horizontal Air Discharge Unit Heater (lower right) delivers warmed air horizontally through adjustable discharge louvres in any capacity within the respective ranges of its ten sizes of 21,000 to 200,000 Btu per hour.

CARRIER Gas-fired Unit Heaters are AGA-approved for all gases. Duct type at right. Propeller-fan type at left (made also in smaller design for lower ceiling heights). Solidly built—featuring exclusively *16*-gauge ALUMINIZED STEEL heat exchanger. Capacities range from 50,000 to 230,000 Btu per hour input.

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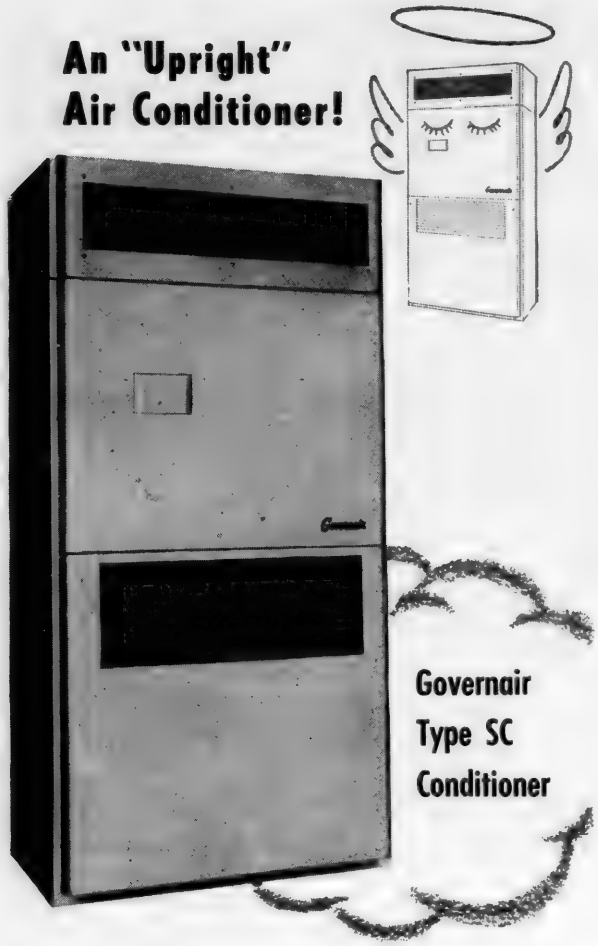

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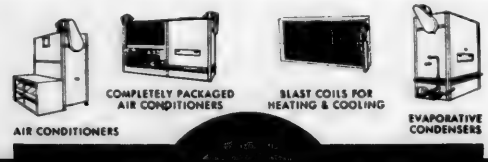

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*Type SCU Conditioners Patent No. 2,297,938

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(*Continued from page* 170)

The same comments would also apply to the heating coil hooked-up for a vacuum system. The piping diagram shows thermostatic traps and check valves installed in addition to a float and bucket trap. The thermostatic traps and check valves could both be eliminated if a float and thermostatic trap or an inverted trap with a thermic element were installed in place of the thermostatic traps and check valves shown in the diagram.

The piping details to the open gravity system show a check valve to be used as a vacuum breaker. The check valve should be eliminated for reasons as given, and in case the coil developed water hammer, an automatic air vent should be installed which would break the vacuum and eliminate the air in the system. In this same piping diagram, I do not believe that the open air relief to the atmosphere should be installed as this also would aggravate the corrosion condition in the return line.

The previous comments regarding the float and bucket trap apply to the open gravity system using two coils. The float or bucket trap should be replaced with a float and thermostatic trap or an inverted bucket trap with a thermic element. This would eliminate the check valve and thermostatic traps. Here again, if water hammer did occur, which is very seldom on a conventional heating coil, an air vent could be installed ahead of the trap.

E. J. Williams
Mechanical Engineer
Abbott Laboratories
North Chicago, Ill.

Canadian Degree-Days for January, 1954

City	January		Cumulative	
	1954	Normal	1954	Normal
Calgary, Alta.	2086	1609	6175	5311
Charlottetown, P.E.I.	1445	1463	3950	4328
Crescent Valley, B. C.	1352	1352	4327	4631
Edmonton, Alta	2255	1814	5543	5798
Fort William, Ont.	2005	1807	5606	5622
Grande Prairie, Alta.	2468	1841	6190	6000
Halifax, N. S.	1250	1283	3333	3898
London, Ont.	1370	1336	3763	4013
Medicine Hat, Alta.	2077	1643	4580	5032
Moncton, N. B.	1548	1528	4226	4714
Montreal, P. Q.	1742	1552	4285	4648
North Bay, Ont.	1885	1658	5066	5161
Ottawa, Ont.	1787	1646	4498	4923
Penticton, B. C.	1252	1184	3597	3810
Porquis Junction, Ont.	2182	2052	5992	6300
Prince George, B. C.	1814	1615	5051	5372
Quebec City, P. Q.	1786	1696	4677	5207
Regina, Sask.	2295	2037	5640	6373
St. John, N. B.	1507	1417	4072	4386
Saskatoon, Sask.	2412	2027	5872	6276
Toronto, Ont.	1353	1304	3472	3948
Vancouver, B. C.	991	893	2891	3061
Victoria, B. C.	891	815	2711	2725
Windsor, Ont.	1215	1283	3310	3729
Winnipeg, Man.	2295	2111	5765	5316

*These data are supplied through the courtesy of the Meteorological Division, Air Service Branch, Department of Transport, Canada.

The department reports a slight revision in the figure for December for Edmonton, Alta., as published in last month's issue. Corrected figure is 1279.

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GRAPHICAL SELECTOR FOR AIR CLEANERS

The accompanying chart and table, compiled by S. Sylvan of American Air Filter Co., Inc., cover an air filter range with concentrations varying from 0.001 to 3 grains per 1,000 cu ft, and a dust collecting range with concentrations varying from 0.003 to 100 grains per cu ft. The commonly encountered ranges of concentration and particle size for many dust producing operations can be plotted on the chart from Table 1 in a manner similar to that shown for the example which follows. For comparative or unknown conditions, these data will be sufficient, although variations either exceeding or falling short of the concentrations shown will be found. For applications not given in the table, it will be necessary to select a point on the chart by comparing with an operation that is shown. This comparison can be made on the basis of type of aerosol, method of generation, capture velocity at and location of the hood, and choice of excessive or minimum air volumes. Experience with the operation will also be of great aid in proper selection of concentration.

A suitable collector will be selected for a lime kiln to illustrate how the chart is used. Referring to Table 1, the concentration and mean particle size of the material leaving the kiln will lie between 1 and 50 grains per cu ft and 3 to 25 microns respectively. Striking the geometric mid point of each range, on Fig. 1, one can assume an inlet concentration of 7.5 grains per cu ft and inlet mean particle size of 9 microns. Projection of this point vertically downward to the collection efficiency portion of the chart will indicate that a low resistance cyclone will be less than 50% efficient; a high efficiency centrifugal will between 60 and 80% efficient and a wet collector, fabric arrestor and electrostatic precipitator will be 97% plus efficient. The latter three collectors are often preceded by a centrifugal precleaner, so that a high efficiency centrifugal will be selected. Using the average or center line of this group, the efficiency will be 70%. Therefore, the effluent from this collector will have a concentration of 7.5 (1.00 − .70) = 2.25 grains per cu ft. Draw a line through the initial point with a slope parallel to a selected average of the lines marked "industrial dust." Where deviation is not known, using the average of this group of lines will normally provide a margin of safety in predicting the mean particle size of the collector effluent. Where this line intersects the line marked 2.25 grains per cu ft indicates the mean particle size of the collector effluent. This is 6.0 microns.

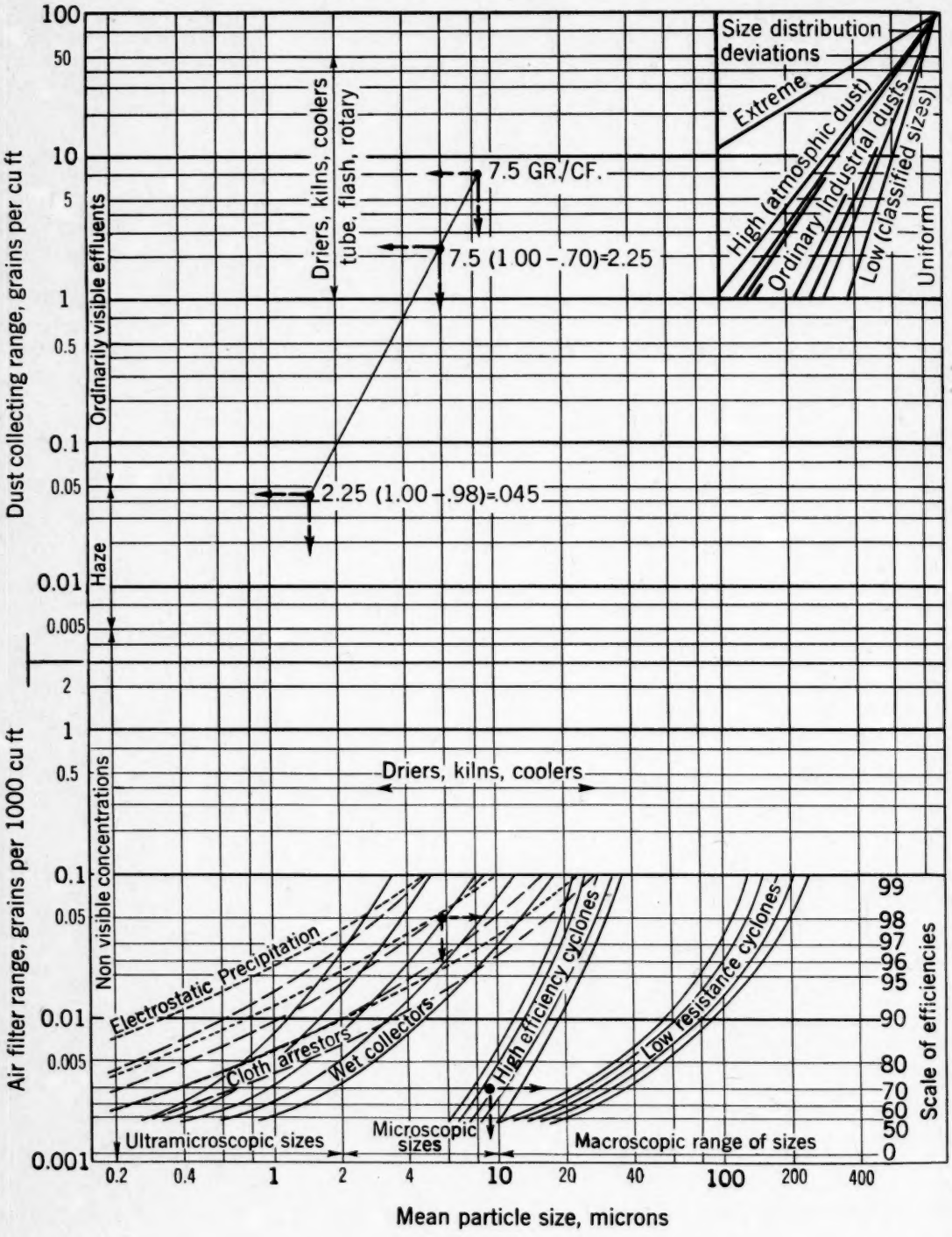
A projection of this point of collector effluent vertically downward shows that a second high efficiency centrifugal will be less than 50% efficient. A wet collector, fabric arrestor and electrostatic precipitator will be not less than 93% efficient. Selection of an average wet collector will show an efficiency of 98%. The effluent leaving this collector will have a concentration of 2.25 (1.00 − .98) = .045 grains per cu ft. Using the line initially drawn, at the point where it intersects the line of .045 grains per cu ft will indicate a mean particle size in the effluent of 1.6 microns.

This chart enables anyone encountering a dust control problem to select two important variables, concentration and mean particle size. By knowing these conditions and the amount of collection efficiency needed, the necessary collector or collectors can be selected so that one can closely predict the concentration and mean particle size of the material going to the atmosphere. Selection and arrangement of particle size, concentration, and collector efficiency ranges are guided by various considerations.

Table 1. — Concentrations and Particle Sizes of Dusts from Various Sources

Dust Source	Range of Concentration Grains per Cu Ft	Mass Mean Particle Size, Microns
Abrasive cleaning: blasting, tumbling (grit, sand) mills	0.5 to 15.0	3 to 10.5
Driers, kilns, coolers: tube, flash, rotary	1.0 to 50.0	3 to 25
Melting furnaces: brass, steel, blast, smelter, cupola	0.2 to 10.0	5 to 20
Fly ash: hand, stoker, pulverized coal firing	0.2 to 5.0	8 to 18
Foundry sand systems	3.0 to 7.0	2 to 10
Foundry shakeouts	0.5 to 3.0	0.8 to 3
Metal grinding	.05 to 0.5	10 to 100
Fumes from metal working	.005 to .014	0.2 to 0.7
Oil mists	.014 to 1.0	0.5 to 3.0
Acid mists from open surface tanks	.005 to .014	0.5 to 3.0
Atmospheric dust: rural	.00002 to .00005	0.3 to 3.0
Atmospheric dust: city	.00005 to .0002	
Atmospheric dust: industrial	.0002 to .0075	
Pneumatic conveying	50 to 20,000	Over 100

Most dusts are composed of particles of many different sizes. Airborne dusts generally have a limiting upper particle size but contain a gradation of particles. The most common unit of particle size is the micron, defined as 1/1,000 millimeter (1/24,500 inch); it is normally designated by the symbol μ. The average or effective diameter of the particle usually designates the particle size. Differentiation between small, medium and large particles is arbitrary. On the accompanying chart, differentiation in size is shown as ultramicroscopic (ranging from 0 to 1 micron), microscopic (ranging from 1 to 10 microns), and macroscopic (ranging from 10 to 1,000 microns).



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FOR FREON
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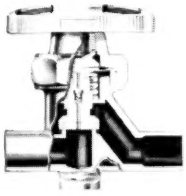
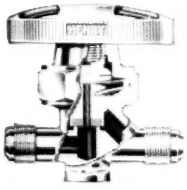


STANDARD TYPE

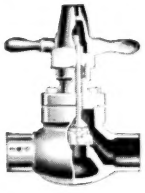
Ball check in balancing channel permits diaphragm inspection and replacement with valves under line pressure. Sizes, ¼" thru ⅝" flare; ¼" thru 1⅝" O.D. Solder, ¼" thru ½" F.P.T.



BLUE BANTAM TYPE

Same as standard Balanced-Action valve except that diaphragms cannot be inspected or replaced under line pressure. Size ¼" thru ⅝" flare and O.D. Solder.

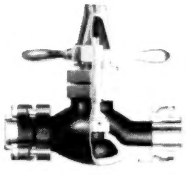
PACKED VALVES
FOR FREON
Bronze-Wing Cap Type



Globe and angle types with solder connections, bolted bonnets, sizes ⅞" thru 5⅛" O.D.

SEMI-STEEL WING CAP TYPE

With bolted bonnets and square companion flanges. Furnished with brass tailpieces (O.D. Solder) 1⅜" thru 5⅛" or with steel tailpieces for welding to pipe, sizes 1¼" thru 5".



Also Globe and angle types with F.P.T. connections, sizes ½" thru 2".

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Permanent-Mold Iron and Semi-Steel

Compact and strong with self-aligning stem disc. Sizes (F.P.T.), screw bonnet: ¼" thru 1", bolted bonnet 1¼" thru 2"—with flange connections 1¼" thru 5".

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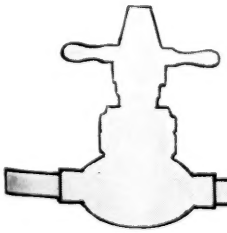

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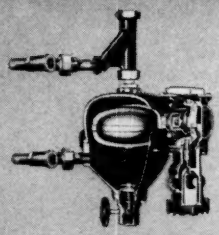
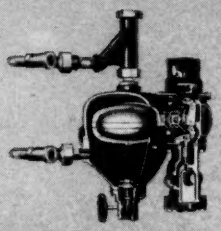
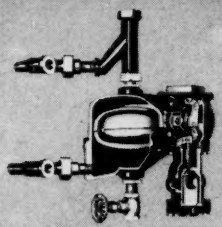


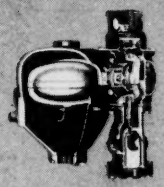
No. 47 Boiler Water Feeder — for hand-fired steam heating boilers up to 5000 sq. ft.



No. 47-2 Feeder - Cut - off Combination for automatically fired steam heating boilers up to 5000 sq. ft.

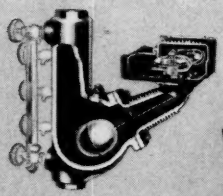


No. 147 Feeder Cut-off Combination — similar to No. 47, but with higher feeding level for small process boilers.



No. 247-2 — same as No. 47-2, but for installation with 1" equalizing pipes.

No. 51-2 Feeder Cut-off Combination for automatically fired heating boilers up to 5000 sq. ft.



No. 157 Water Column Type High Pressure Pump Control, Cut-off and Alarm— for boilers of any size up to 150 lbs. pressure.

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It isn't likely you'll ever use all these McDonnell Products. But for those special jobs that do come up it's good to know that McDonnell offers liquid level controls, flow switches and similar products for practically every need. Many of them are shown here. For full information, on these and the complete McDonnell line-up —

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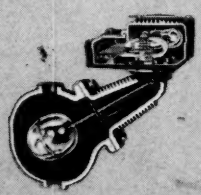
No. 53-2 Feeder Cut-off Combination — Similar to No. 51-2, but built for higher pressure, up to 75 lbs.

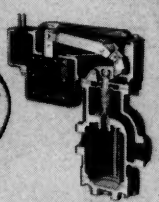
No. 69 "Built-in" Low Water Cut-off — Typical of many "built-ins" for installation in tappings provided in modern boilers.

No. 767 Low Water Fuel Cut-off — for No. 14 blow-off, easy installation in opening in boiler.



No. 150 High Pressure Pump Control, Cut-off and Alarm—for boilers of any size up to 150 lbs. pressure.

No. 61 Low Water Fuel Cut-off — for equalizing pipe installation on low pressure steam boilers.

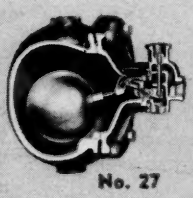


No. 101 Electric Water Feeder— operated by No. 67 or liquid level switches.

No. 21

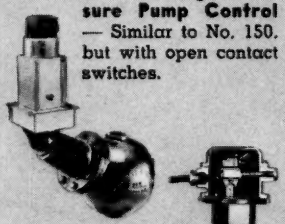
No. 121

No. 221



No. 27

Make-up Water Feeders — to maintain adequate water supply in receiving tanks. Nos. 21, 121 and 221 are installed right in tank openings; available in various flange forms and sizes as shown to fit existing openings. No. 27 is for external application, with equalizing piping.

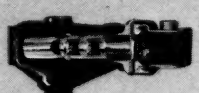


No. 154 High Pressure Pump Control — Similar to No. 150, but with open contact switches.

No. E-2 Flow Switch — Completes (or breaks) circuit when flow starts or stops.

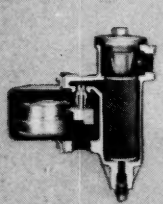
No. 18 Float Valve — for maintaining water level in humidifier pans and many other liquid level control jobs. Also available in float chamber with cover, as No. 518.

No. 230M-2 — Manifold series pressure relief valve for large hot water boilers. Btu-rated. ASME standard.

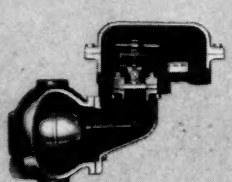


No. 80 Switch — Three wire high- or low-level alarm or pump control on oil storage tanks.

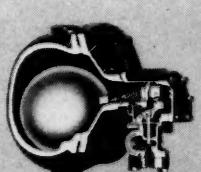
No. 230 Series Pressure Relief Valve for hot water and hot water Btu-rated standard.



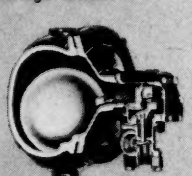
No. L-8 Constant Level Valve — maintains constant fuel oil pressure on burner.



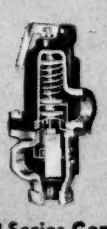
No. 65 Explosion-proof Electric Controller — Underwriters' approved for hazardous locations.



No. 355 Large Capacity Float Valve— has many uses on tanks, stills, receivers, etc.



No. 455 Feed Water Controller — for multiple boiler jobs, to divert pump discharge into proper boiler.



202 Series Combination T & P Relief Valves—for hot water tanks and heaters. AGA rated.

No. 201 Temperature Relief Valve for hot water and heaters, tested, rated, listed.